A Balance between Technology and Nature

- An environmental 'design/build'
  office and fabrication shops,
  Bozeman, Montana

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12/22/92
introduction:

In the 1970's, people started to realize that most of the energy resources were polluting the air and non-renewable. Now in the 1990's people again are concerned with the amount of natural resources society is using and the impact on the environment. The world is beginning to take notice of these problems. The world wide environmental conference at Rio de Janeiro, Brazil in 1992, shows the concern people have about our impact on the ecology. The only ecology that lets human life as we know it, to exist.

The building industry has a direct relationship with the environment. Consider that residential and commercial buildings' demand 37% (Hunt, pg. 9) of the total energy consumed in the United States. Designers of the built environment can influence the quantity of energy a building uses. In terms of, the embodied energy (energy used to mine, harvest, manufacture, transport, and construct a building), and the energy used once the building is occupied (electrical, heating, cooling, and lighting loads).

I believe the building industry and public is developing a trend towards energy conservative architecture. Designers are dealing with energy related decisions earlier and through-out the entire design process. If they are not, they should be. Every design and task the building industry performs can be done in an energy conscious way. In my opinion, designers along with the other building professions, have an obligation to do all they can to conserve energy in the built environment. One of the problems in the past has been the way designers saw the effect of their designs on it's surroundings. Historically, buildings have tried to adapt the environment to suit the needs of people. I think we as designers and humans, need to adapt to the environment. I am searching to find a balance between our impact on the ecology and it's impact on us. Why fight something that works quite well, and provides us with so much. The knowledge and technology is there to enable us to work with nature, we just need to employ it. With this implementation, people will benefit by stretching our resources' life spans, and encouraging a greater sensitivity to the natural environment and it's wondrous attributes.

Technology itself is not causing the problems seen in our ecology, the cause comes from how humans are using it. There is no reason for hesitation among designers and builders to incorporate ecological and energy conserving systems. Many of which can be done without using new materials and products. For instance, proper orientation to the sun can reduce heating loads typically done by fossil fuels.

Designers and builders should stop thinking only in terms of the price the client pays, but also in terms of the price society must pay; the
embodied energy of their designs. An analogy that comes to my mind is, ‘The Tragedy of the Commons” (Hardin).

“The tragedy of the commons develops in this way. Picture a pasture open to all. It is to be expected that each herdsman will try to keep as many cattle as possible on the commons.......

As a rational being, each herdsman seeks to maximize his gain. Explicitly or implicitly, more or less consciously, he asks, ‘What is the utility to me of adding one more animal to my herd?’ This utility has one negative and one positive component.
1. The positive component is function of the increment of one animal. Since the herdsman receives all the proceeds from the sale of the additional animal, the positive utility is nearly +1.
2. The negative component is a function of the additional overgrazing created by one more animal. Since, however, the effects of overgrazing are shared by all the herdsman, the negative utility for any particular decision-making herdsman is only a fraction of -1.

Adding together the component partial utilities, the rational herdsman concludes that the only sensible course for him to pursue is to add another animal to his herd. And another.

But this conclusion is reached by each and every rational herdsman sharing a commons. Therein is the tragedy. Each man is locked into a system that compels him to increase his herd without limit - in a world that is limited. Ruin is the destination toward which all men rush, each pursuing his own best interest in a society that believes in the freedom of the commons. Freedom in a commons brings ruin to all.

Maybe we can to think of our ecology in terms of a world wide commons? One drawback to the idea of saving the world environment is that there is no immediate reflection or consequence of our wasteful use or conservation of energy. The industrial age is completing a cycle and is showing us what our development has done. Acid rain is killing whole lakes and disintegrating historic buildings. Pollution is causing such poor air quality, that health disabilities are being discovered. I am not suggesting saving the planet. The planet has survived cataclysmic catastrophes before, and will continue long after the living things on it’s surface. What we should be concerned with is the ecology that sustains human life. The air, water, soil, and vegetation that lets us live. I am not against the use and development of technology. But I am against the attitude that we can take resources from the ecology and not give something equal in return. A balance must be found in order for the ecology to sustain human life. Perhaps by putting society’s welfare above
individual welfare, people can get to work and solve our ecological dilemma. The task is tremendous and will take time, but I believe people are becoming environmentally conscious and trying to change their habits to ones that will build a sustaining ecology.

Understandably, it is hard to change attitudes and values by just intelligent rhetoric. Only by setting examples can a direction be established, examples that can be seen, heard, and touched. The AIA has a motto printed in the Environmental Resource Guide, which seems to express a new and needed attitude, “Think globally, Act locally!” (ERG, topic.III.A 2) This motto can be used in the building industry’s process, even as a philosophy. This thesis is a exploration of ways in which new, as well as old, technologies can direct us towards a sustainable environment. This exploration is to set an example, an attempt to stimulate thought of nature and a sustainable ecology.
Technology, social events, and tragedy have produced growth and greater complexity in the building industry. Today multiple professions and trades are needed to finish a new building. Land is being developed with cost and time as top priorities, leaving an insensitive and monotonous built environment. However, there is need for higher efficiency and greater care in the design and construction process of our built environment. Materials are being wasted and excess energy is being consumed by faulty communication between the design and construction professions. I believe closer contact could benefit the building industry. Closer than a fax line and telephone. Many design firms have design trades ‘in-house’, but few have fabrication and construction as apart of the company structure. The number of design/build firms are increasing, perhaps because people like the idea of dealing with one entity. The value I see in bringing design and construction professionals together would be the gained understanding of each professions’ capabilities and limitations. Instead of producing pieces and then having to change things, these professions can cooperate to efficiently complete a single vision and goal.

I propose a thesis program that brings these professionals together as a team by putting them in the same building. A client could enter their project in this ‘community’ of trades and have it designed, built and completed by a single group. Some materials will still have to be manufactured and shipped from afar, but ordering and purchasing can be handled by the team. This team would include a design group and construction and furnishing group. The team will emphasize ecological building practices and strategies. The design group brings together architects, engineers, interior designers, and landscape designers. The build group would include carpenters, iron-workers, and cabinet-furniture craftsman.

In times of competitive economic markets these groups and/or offices can freelance their services by taking on projects that may or may not include more than one trade. By integrating their spaces and work areas, access and understanding of each other’s roles can be heightened. The public will benefit from this type of cooperation. Beyond the type of services these professionals will provide, their building will serve as a teaching aid for energy conservation and finding a balanced relationship between people and nature.
design:

This ‘design group’ will be composed of four professional offices; architectural, engineering, interior design, and landscape design. There will be office space that is enclosed for privacy. What is meant by enclosed is, a wall that is fixed but does not reach the ceiling. This partition will provide a high level of privacy, yet not completely shut-off the atmosphere within the rest of the office. With increase in computer drafting and project management acceptance, a space for computer terminals and hardware will be provided. Lighting direction and temperature levels are important to the location and arrangement of these spaces. Using a pencil is still effective and sometimes preferred in the design process. Therefore, drafting table space will be provided. Room for tools and instruments will be provided as well. Lighting level will need to be high for this task.

Architecture
- (3) enclosed offices @ 450 s.f.
- computers (5) @ 300 s.f.
- drafting (4) @ 300 s.f.
1050 s.f.

Engineering
- (2) enclosed office @ 450 s.f.
- computers (3) @ 180 s.f.
- drafting (2) @ 150 s.f.
780 s.f.

Interior Design
- (2) enclosed offices @ 300 s.f.
- computer (2) @ 120 s.f.
- drafting (1) @ 75 s.f.
495 s.f.

Landscape Design
- (2) enclosed office @ 300 s.f.
- computer (2) @ 120 s.f.
- drafting (1) @ 75 s.f.
495 s.f.
build:

The 'build group' will include a welding/metal shop, cabinet/wood shop, and a contractor's garage. The wood shop will house a large space to build cabinets (residential and commercial) and construct custom furniture and furnishings. Truck access will be needed for shipping and receiving materials to this area. This space will be a heat generator so ventilation techniques will be important. A painting room will be needed for the shop's work. The space will have its own ventilation and filter system. Space will be designed to accommodate room to draft, bid projects, purchase materials, and one enclosed office.

The steel fabrication will take place in a large space separated from the cabinet shop— not only because sawdust does not mix with a welding arc, but also to reduce the cooling loads of both shops. The fabrication space will have a crane to move the steel, and be able to load and unload a semi-truck. Adjacent to this area a primer painting room will be enclosed, adequate ventilation and filtered exhaust will be needed. Space will be designed to accommodate room to draft, bid projects, purchase materials, and one enclosed office.

The contractor's area will include an enclosed office and area for cost estimating and material purchasing. A separate space will be designed for field carpenters to use for making phone calls, check-in and making group decisions. A garage will be provided to allow equipment to be maintained and storage of tools and equipment.

**Cabinet/Wood Shop**
- open space @ 1700 s.f.
- painting space @ 150 s.f.
- shop storage @ 200 s.f.
- (1) enclosed office @ 150 s.f.
- computer/draft/bid @ 200 s.f.
  2400 s.f.

**Steel Fabrication**
- open space @ 2000 s.f.
- shop storage @ 200 s.f.
- painting space @ 200 s.f.
- (1) enclosed office @ 150 s.f.
- bid/purchase/draft @ 200 s.f.
  2750 s.f.
Contractor

- (2) enclosed offices @ 300 s.f.
- bid/purchase @ 200 s.f.
- carpenters' office @ 150 s.f.
- garage @ 600 s.f.
- storage @ 200 s.f.

1450 s.f.

commons:

There will also be spaces that are used by the design and build offices cooperatively. Space for a secretary pool and visitor waiting will be designed in a semi-private and lively way. These secretaries will be for all offices in the company. Connected to these spaces will be a storage room for files, drawings, and models. Included in the room will be space for a print machine and copier. Ventilation for the blue print machine will be critical in order to maintain good indoor air quality. A library is intended to gather and supply the company with resource literature. This information may be supplied from personal donations as well as from the company. This will not be a major space, but there will be enough room to read and research comfortably. A model making space will be provided, enough area for two projects. This area will be spacious and well lit for viewing and building the models. A large conference room will be important for showing presentations or holding small organizational meetings. A smaller meeting/conference space will be needed for daily office business and client interviews. An entry space will be designed to create a circulation hub. This 'orientation' space will also provide area for members of this design/build company to display their work and for any new environmental building technology or material. A social space will be designed to promote employee interaction within the company. This space will provide lunch storage and eating areas along with sitting and reading areas. The environmental attributes of this program and site shall be evident. Which will allow the design/build company to demonstrate them to their clients and the public.
**Common space**
- secretary/waiting @ 400 s.f.
- file/storage/print @ 250 s.f.
- library @ 400 s.f.
- model making @ 300 s.f.
- conference @ 600 s.f.
- meeting room @ 400 s.f.
- showroom/entry @1000 s.f.
- lounge @ 400 s.f.
- mechanical spaces @ 800 s.f.
- restrooms @ 500 s.f.

<table>
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<th>Design</th>
<th>2820 s.f.</th>
</tr>
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<tbody>
<tr>
<td>Build</td>
<td>6550 s.f.</td>
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<tr>
<td>Commons</td>
<td>5050 s.f.</td>
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<tr>
<td><strong>Total</strong></td>
<td>13,420 s.f.</td>
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<tr>
<td><strong>circulation (10%)</strong></td>
<td>1342</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>14,762 s.f.</strong></td>
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The site is located in Bozeman, Montana, at intersection of Peach Street and Wallace Street. It extends one-hundred fifty feet along Peach street and three-hundred twenty-five feet along Wallace street to Cottonwood Street. The lot is zoned as ‘light-manufacturing’. There is residential zoning across Peach Street to the south. Older pine and deciduous trees shroud this street front making it difficult to view the residences. To the northeast of the site is a historical district claiming three residences and two industrial plants. The residences are occupied and shrouded in trees similar to those of the south. Directly west are businesses that seemed relatively new. The east side of the lot has a freight company’s truck yard and a pumping station with large above ground tanks. These buildings are older and in disrepair. The buildings in this area are more functional than esthetic with a wide variety of materials. To the north of the site is a unused grain distribution building, which seems to dominate the area. This area also has many mechanical towers, stacks, grain elevators which give it an old industrial feel and character.
goals: to demonstrate--

A. conservation of energy
B. increased user awareness of nature at the workplace
C. increased building industry efficiency

objectives:

A.1. use of site's micro-climate as design driver
   • buffer/direct winds
   • block/allow sunlight
2. utilize on-site energy resources
   • sunlight
   • rainwater
   • vegetation
   • soil
3. embodied energy
   • materials
   • labor
4. recycle resources
   • generated heat
   • graywater
   • materials

B.1. allow vegetation to play large role inside and outside
   • use of earth and vegetation as space definers
   • sculpture
2. enhance seasonal changes
   • cycle of growth and hibernation
   • colors
3. display natural energy systems
   • use systems as building elements
   • building form
4. contrast/abstract nature and technology
   • structure
   • materials

C.1. a commons
   • social/business spaces
2. little division between professions
   • single space
   • minimize visual separation
3. shared view
   • building plan
   • view windows
4. public visibility
   • display space
   • form connections
   • visual connection between professions' areas
bibliography:


references:


Bozeman Master Plan.

Bozeman Zoning Ordinance.


‘Architecture’ magazine:


A Balance between Technology and Nature

- An environmental design/build office and fabrication shops.
  Bozeman, Montana

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