

What Does Sustainability Mean for the Built Environment?

A Workshop on Factors, Issues, and Priorities

Greenprints '99 – February 22-24, 1999 – Decatur, GA

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Introduction

With increased awareness of the negative impacts built facilities have on the natural environment, the concept of sustainability is heard more and more in circles of practitioners who design, built, operate, maintain, and use built facilities. But while talk of sustainability and making built facilities more sustainable increases, a disparity still exists about the meaning of the concept, including an operational definition and means for assessing the sustainability of the built environment. No commonly recognized definition of sustainability exists, let alone one that applies specifically to the built environment (Pearce 1998).

Toward resolving this disparity of understanding, several research projects are ongoing at Georgia Tech Research Institute, including an assessment of practitioner perceptions of the meaning of sustainability for the built environment. A recent conference on Sustainable Communities and Building, the Greenprints '99 conference, offered an opportunity to conduct a workshop with volunteer practitioners as part of the assessment of those perceptions.

The general structure of the workshop included two portions: interactive individual and small group exercises, and an informational presentation describing Georgia Tech's research on the state of the knowledge base on sustainable construction. The primary purpose of this document is to describe the process and outcomes of the interactive exercises. Slides used in the second part of the session are included as a link/attachment at the end of this document.

Demographics of the Workshop

The workshop was conducted as part of the 1999 Greenprints Conference on Sustainable Communities and Building, held February 22-24 in Decatur, GA. Approximately 450 designers, builders, consultants, government employees, developers, private citizens, and other participants attend this annual conference and exposition. While participants are predominantly from the southeastern United States, the conference is growing in recognition as one of the premier national conferences on green building and sustainable community issues in the United States and is bringing an increasing number of participants from around the country.

From this diverse population of attendees, sixteen participants attended the elective workshop held on the afternoon of the second day of the conference. Participants were asked to complete and return a worksheet that included a checklist of roles in sustainable construction, and instructed to check all that applied to them. Table 1 shows the results of

the roles checklist and describes the demographics of the workshop participants. Four participants did not indicate their roles on the checklist, while some participants checked multiple roles. Nonetheless, the table indicates a significantly diverse mix of practitioners and service providers, which was confirmed by an introductory “ice breaker” in which participants raised their hands to indicate what kind of stakeholder they are with respect to the built environment.

Table 1: Checklist of Roles in Sustainable Construction

Responses	Role
2	Owner
2	Contractor
7	Designer/Architect/Engineer
0	Materials Manufacturer
3	Consultant
2	Researcher
2 [†]	Teacher/Professor
2 ^{††}	Other

The workshop was facilitated by Annie Pearce of Georgia Tech’s Sustainable Facilities and Infrastructure Program. Pearce is a research engineer with a background in sustainability and construction management.

Methodology and Results

The interactive group exercises followed the method of “Think-Pair-Share” (Eison 1997) to elicit the participants’ knowledge about the meaning of sustainability for the built environment. Think-Pair-Share is a method for quickly eliciting answers to a question from a medium- to large-sized group. The facilitator begins the exercise by explaining the Think-Pair-Share process, in which participants first think about the answer to the question individually, then pair with their neighbor to discuss individual answers. The final step is for each pair of participants to share their consensus answer with the group. The facilitator typically records each pair’s answers directly without criticism, using media such as flip charts or transparencies that are visible to the entire group. The Think-Pair-Share exercise is concluded with a facilitated group discussion of similarities, differences, and patterns in the answers given by the groups. The outcome is a consensus-driven answer, agreed upon by the group as a whole, to the question posed at the beginning of the exercise.

A standard session worksheet can provide the participants with a structure for undertaking the exercises, and can be submitted afterward to provide a record of the

[†] One respondent was a professor at the University of Georgia teaching school design and education, while the second respondent was a professor at Auburn University College of Architectural Design and Construction, teaching environmental controls courses.

^{††} One respondent described his/her role as an “interested organizer/environmentalist”, while the other elaborated his/her role as a “writer + public relations/media placement”.

participants' thought processes. Figure 1 shows the worksheet provided to participants to structure the workshop and provide feedback to the facilitator.

As described to the group by the facilitator, participants were given approximately two minutes to individually brainstorm answers to the question, "What factors or issues are most important for built environment sustainability?" As noted on the worksheet, participants were requested to circle the five most important factors in their self-generated list. One participant asked what was meant by the term "built environment". The facilitator responded to the group that the built environment consists of built facilities, their sites, and the infrastructure that connects them. Some participants began brainstorming answers to the question prior to the timed portion of the session, since worksheets were distributed at the door as participants entered the room.

The outcome of the individual brainstorms is shown in Table 2. Items marked among an individual's top five factors are indicated with an asterisk to the left of the item. Frequency of responses are indicated by the number to the right of the item. One participant who was interested in using the Think-Pair-Share technique in her teaching did not return the worksheet; her responses are not included in Table 2. Some individuals provided comments or descriptions of their factors, which are indicated in the "Comments" column.

Figure 1: Session Worksheet

What Does Sustainability Mean for the Built Environment?

How do you describe your role in sustainable construction? Check all that apply.

- _____ Owner
- _____ Contractor
- _____ Designer/Architect/Engineer
- _____ Materials Manufacturer
- _____ Consultant
- _____ Researcher
- _____ Teacher/Professor (please list institution & subject areas)
- _____ Other (please describe)

Think - What factors or issues are most important for built environment sustainability? Circle the five you believe are most important.

Pair - Talk with the person sitting next to you. What are the top three most important factors? What are the three least important factors?

Most Important Factors:

- 1)
- 2)
- 3)

Least Important Factors:

- 1)
- 2)
- 3)

Share - Tell the group your top three factors.

Table 2: Built Environment Sustainability Factors Identified by Individuals

Top 5	Factor	Comments	Frequency
*	Human comfort		6
*	Education & awareness	Training, acceptance, attitude, reliability, teamwork	5
*	Cost/Money/Economics		4
*	Affordability		4
*	Building as a learning experience	Inspire; teach by example	4
*	Air emissions/quality		4
*	Recycling/recyclability		4
*	Human scale/Scale of project		3
*	Understanding of life cycle cost/cost awareness	First cost vs. life cycle cost	3
*	Minimal use/consumption of resources		3
*	Reduction in energy consumption/energy use		3
*	Healthy indoor environment/indoor environmental quality		3
*	Proper allocation & recognition of environmental costs of building systems & construction methods	Industry-wide	3
*	Culture & values		3
	State of the art in technology		3
	Geological factors		3
*	Removing disincentives		2
*	Economic impact		2
*	Low impact of producing buildings	Both today and future; Materials & methods	2
*	Public education regarding the environmental costs of purchasing or life style choices		2
*	Water conservation/efficiency		2
*	Resource-efficient construction	Less material used during construction	2
*	Resource conservation		2
*	Energy efficiency		2
*	Embodied energy		2
*	Livability	Includes comfort, safety, and affordability	2
*	Environmental impact	Materials and energy	2

*	Maintenance		2
*	Population control		2
*	Lifestyle and associated consumption	Develop a culture that uses less “stuff” & that spends more time enjoying the arts which use less stuff	2
	Social factors/costs		2
	Diversity		2
	Safety		2
	Noise pollution		2
	Material toxicity	Use less toxic materials	2
	Materials selection	Impact in production/disposal; materials sustainability	2
	Land use & management		2
	Infrastructure development		2
	Ecological factors/costs		2
*	Economic stability		1
*	Long term financial cost to the owner		1
*	Flexibility or adaptability over long life cycle		1
*	Natural systems health		1
*	Educational effects		1
*	Incentives		1
*	New aesthetics	Beauty & excitement	1
*	Human enjoyment		1
*	Environmental stability		1
*	Water emissions/quality		1
*	Wise resource use	Long-term planning, worldwide prosperity	1
*	Resource consumption of ongoing facility operation	Energy, materials, etc.	1
*	Use less land surface	Smaller footprint	1
*	Indoor lighting comfort	Aesthetics & beauty	1
*	Connection & use of natural environment	Temperature, light, air, humidity	1
*	Earth friendly to the environment		1
*	Habitat restoration	Smaller per capita sq. ft. [impact]	1
*	Mandating standards		1
*	Enforcing standards		1
*	Lack of spirituality	Greediness; “me” generation	1
	Improvement in social environment	Encourage stronger societal relationships & interactions	1

Human inter-relationships	1
First cost	1
Overcoming “business as usual” attitude	1
Energy production	1
Meeting human needs	1
Impact on living systems	1
Waste management	1
Pollution	1
Birth control	1
Community participation & planning	1
Commuting	1
Location/orientation	1

Following the two minute individual brainstorming, participants were instructed to pair with the person sitting next to them to develop an answer to the second set of questions: “What are the top three most important factors?” and “What are the three least important factors?” The purpose of these two complementary questions was to stimulate prioritization of brainstormed factors according to the “Plus Three-Minus Three” technique. Plus Three-Minus Three is a technique used to facilitate brainstorming by framing a question (in this case, prioritization of factors) from two opposite perspectives (Preiser et al. 1988). While effective in many situations, the “Minus Three” portion of the exercise was ineffective in this session. As one participant pointed out, “All of these issues are important [for built environment sustainability]!” Only two participants filled out the “Minus Three” or Least Important Factors section of the worksheet. Several participants recorded less than three responses for the “Plus Three” section of the worksheet, but provided their answers directly in the third part of the exercise.

The outcomes of the Pair part of the exercise are shown in Tables 3 and 4. To determine a ranking for the most important items, the items were ranked based on a point system, which assumes that each pair of participants allocates three points to its most important item, two points to its second-most important item, and one point to its third-most important item. Not all groups identified three items, resulting in a total of 45 points being allocated for all identified items. To rank the items, the total number of points was calculated and averaged into a percent of points received for each item. Table 3 shows the items sorted in order of the percent of points received.

Table 3: Most Important Factors for Built Environment Sustainability

Factor	Sum	% of points	Rank
Livability	5	11%	1
Environmental Impact	4	9%	2
Education/Awareness	3	7%	3 (tie)
Energy efficiency	3	7%	3 (tie)
Money/Cost/Economics	3	7%	3 (tie)

Proper recognition/allocation of environmental costs	3	7%	3 (tie)
Recycling	3	7%	3 (tie)
Resource conservation	3	7%	3 (tie)
Understand life cycle cost	3	7%	3 (tie)
Affordability	2	4%	10 (tie)
Earth-friendly/non-damaging to environment	2	4%	10 (tie)
Embodied energy	2	4%	10 (tie)
Enforcement of standards	2	4%	10 (tie)
Water conservation	2	4%	10 (tie)
Air quality - indoor & outside	1	2%	15 (tie)
Comfort	1	2%	15 (tie)
Habitat restoration	1	2%	15 (tie)
Mandating of standards	1	2%	15 (tie)
Scale	1	2%	15 (tie)
Total points allocated =		45	100%

Table 4 shows the least important factors sorted in order of the percent of points received. To determine a ranking for the least important items, the items were ranked based on a point system, which assumes that each pair of participants allocates one point to its least important item, two points to its second-least important item, and three points to its third-least important item. Only two groups identified least important factors, resulting in a total of 4 points being allocated for all identified items. To rank the items, the total number of points was calculated and averaged into a percent of points received for each item.

The Share portion of the Think-Pair-Share exercise involved each pair in turn telling the group their three most important factors for built environment sustainability. On transparencies, the facilitator recorded each pair's responses directly or with minor paraphrasing agreed upon by each pair. In several cases, groups identified the same factor as being important, in which case the facilitator marked multiples using tick marks on the transparencies. With the group's participation and agreement, an informal hierarchy was established of the most important factors contributing to built environment sustainability. Table 5 shows the informal hierarchy and frequency of responses associated with the group's consensus-based outcome of the Think-Pair-Share process. The frequency represents the number of pairs who indicated that the respective items were among their top three most important factors. As such, frequency is a rough indicator of importance or priority of each item.

Table 4: Least Important Factors for Built Environment Sustainability

Factor	Sum	% of Points	Rank
State of the art of technology	2	50%	1
Geological factors	1	25%	2 (tie)
First cost	1	25%	2 (tie)
Total points allocated =		4	100%

Discussion and Directions for Future Research

The most frequently mentioned factors by individuals were human comfort (n=6), education and awareness (n=5), cost/money/economics (n=4), affordability (n=4), building as a learning experience (n=4), air emissions/quality (n=4), and recycling/recyclability (n=4). When pairs ranked their top three most important factors, the most important issues were (in weighted order) livability, environmental impact, education/awareness, energy efficiency, money/cost/economics, proper recognition/allocation of environmental costs, recycling, resource conservation, and understanding life cycle cost. In contrast, the top four most important factors when shared with the group were (in order of frequency) cost/economics (n=5), inspire/educate using the built environment (n=3), comfort (n=2), and energy efficiency (n=2).

The last priority ranking corresponds most closely with mainstream views on what is most important for built environment sustainability. However, the variation in ordering for the individual and paired parts of the exercise indicates that many individuals may hold a perception of sustainability different from the mainstream. The only item appearing on all three lists was money/cost/economics, although it was ranked number one in only the whole group discussion. A sub-discussion regarding the least important factors for built environment sustainability led the group to conclude that first cost was or should be among the least important factors in creating a sustainable built environment. Education/awareness, comfort, energy efficiency, and recycling appeared on two of the three lists, and therefore may be reflective of consensus as to the importance of these factors.

This analysis represents a single data point in the whole population of potential group exercises to define built environment sustainability. The evolution of most important factors across the three compilations in the Think-Pair-Share exercise indicates an influence of group interaction on the final hierarchy of factors as shown in Table 5. Different sets of participants with different backgrounds, personalities, and stakeholder roles; a different context for the workshop; and different qualitative research techniques may result in the identification of substantially different sets of indicators and associated priorities. Future research should include replication of this exercise in other contexts and with other participants to verify the outcome of this study. A pre-test to measure participants' knowledge of built environment sustainability prior to the exercise would also help to explain variations in individual responses. Modifications of the study in future research may include cluster analysis or concept mapping by participants to determine the relationships among brainstormed factors, as well as concept mapping with a similar group using a predetermined set of factors such as might be determined from the literature.

References

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Table 5: Consensus Outcome of Factors Important to Built Environment Sustainability

Item	Frequency
• Cost/Economics	5
- Awareness	
- Allocation of	
• Inspire/Educate using the Built Environment	3
• Comfort	2
• Energy Efficiency	2
• Embodied Energy	1
• Magnitude/Scale of Project	1
• Recycling	1
• Air Quality	1
• Maintenance	1
• Water Quality	1
• Population Control	1
• Standards	1
- Enforcement	
- Mandates	
• Lifestyle	1
• New Aesthetics	1
• Occupant Health	1
• Future Considerations	1
- Social Costs	
- Economic Costs	
• Lack of Spirituality	1
• Culture/Values	1
• Livability	1
- Affordability	
- Comfort	
- Safety	
• Environmental Impacts	1
- Materials	
- Energy	