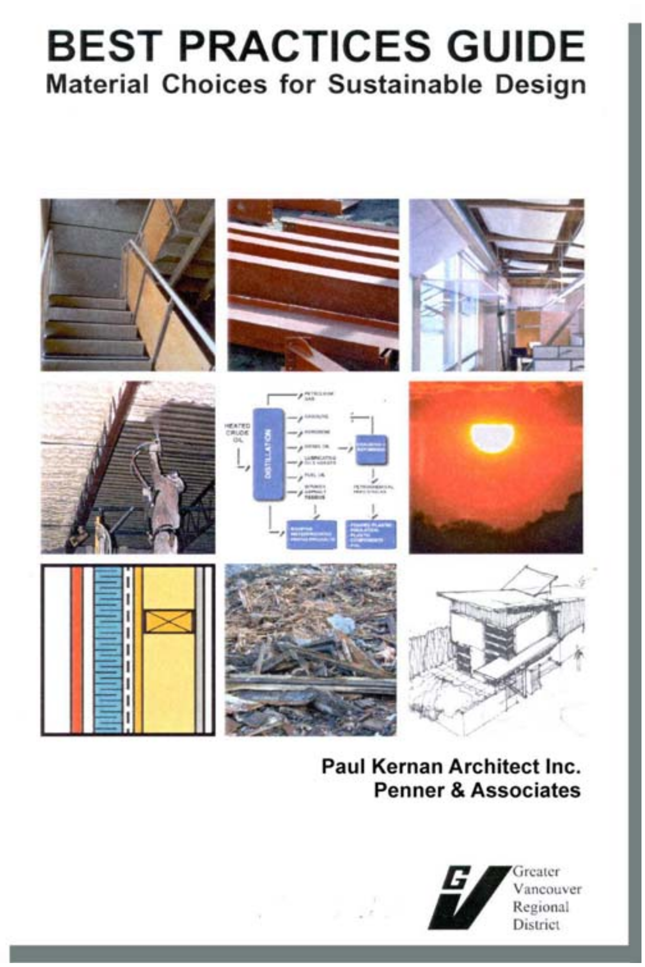
Sustainability 2003

Best Practices Guide – Material Choices for Sustainable Design

Background

The seriousness and immediacy of the environmental issues we now face are such that Sustainable Design can no longer remain the preserve of a small number of specialists and enthusiasts. Building owners and users will increasingly demand higher standards of environmental performance of the construction industry. Architects will need to respond by developing a clear understanding of the nature of environmental pressures, and of appropriate design and construction strategies to reduce impacts. Appropriate material choices to minimize environmental impacts will be a key component of sustainable design.



The Best Practices Guide is intended to provide architects with practical information to assist in selection of appropriate *green* building materials. Background material is provided on environmental issues specific to each material type, and specific selection criteria are provided and prioritized. In all cases material choices are placed within a larger context that discusses performance issues to avoid the use of materials that achieve *green* design goals at the expense of acceptable performance in other areas.

Professional Development Seminar

The Best Practices Guide has formed the basis of a highly successful AIBC Professional Development Seminar. The seminar was presented 3 times in 2001 and at the AIBC Annual Conference in May 2002 and was oversubscribed each time.

Technical

Format	1. Printed document – Colour photocopies with spiral binding
	2. PDF format, available at the GVRD webpage
Contents	89 Pages. 8.5" x 11", double sided with spiral binding
	82 Colour illustrations, photographs and diagrams
Project Timeline	June 2000 to Jan 2001
PD Courses	May 24, 2001, June 13, 2001, Nov 9, 2001, May 2002

INTRODUCTION

BUILDINGS AND THE ENVIRONMENT

Over the last 30 years society has begun to address how our lifestyles, particularly in the affluent West, have contributed, directly or indirectly to environmental problems. Public education campaigns have made many people aware of the impacts associated with automobile use, and of the benefits of recycling paper and other packaging materials. In this context, the relationship between buildings and environmental degradation is not one that immediately comes to mind. The idea that the buildings we inhabit may be directly connected to many of the most threatening environmental stress the planet is facing, is diametrically opposed to our most cherished ideas about hearth and home.

Environmental issues have been on the periphery of architectural practice for many years. During this time attention has shifted from concerns about pollution in the 1960s, to the energy crisis of the 1970s, and to issues of ozone depletion and climate change in the 1990s.

The seriousness and immediacy of the environmental issues we now face are such that Sustainable Design can no longer remain the preserve of a small number of specialists and enthusiasts. Building owners and users will increasingly demand higher standards of environmental performance of the construction industry. Architects will need to respond by developing a clear understanding of the nature of environmental pressures, and of appropriate design and construction strategies to reduce impacts. Sustainable design will become an integral part of everyday architectural practice.

INTRODUCTION

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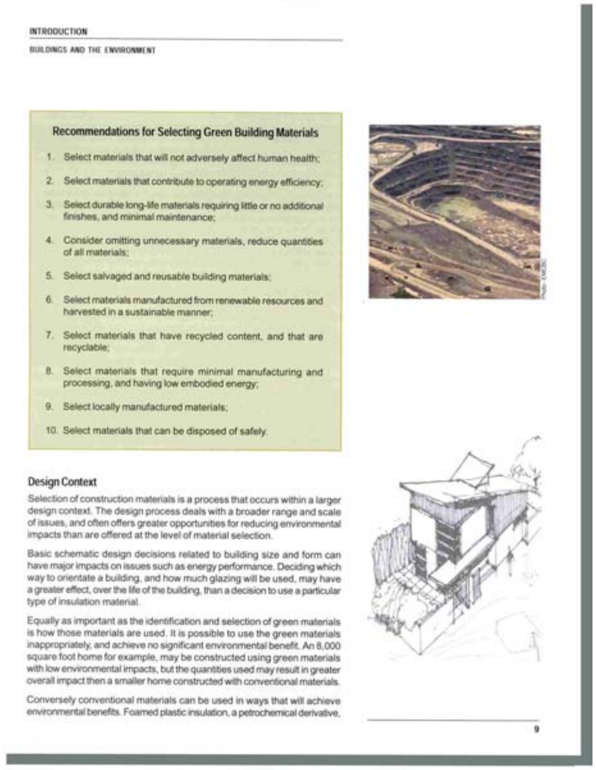

INTRODUCTION
BUILDINGS AND THE ENVIRONMENT

Recommendations for Selecting Green Building Materials

1. Select materials that will not adversely affect human health;
2. Select materials that contribute to operating energy efficiency;
3. Select durable long-life materials requiring little or no additional finishes, and minimal maintenance;
4. Consider omitting unnecessary materials, reduce quantities of all materials;
5. Select salvaged and reusable building materials;
6. Select materials manufactured from renewable resources and harvested in a sustainable manner;
7. Select materials that have recycled content, and that are recyclable;
8. Select materials that require minimal manufacturing and processing, and having low embodied energy;
9. Select locally manufactured materials;
10. Select materials that can be disposed of safely.

Design Context

Selection of construction materials is a process that occurs within a larger design context. The design process deals with a broader range and scale of issues, and often offers greater opportunities for reducing environmental impacts than are offered at the level of material selection.

Basic schematic design decisions related to building size and form can have major impacts on issues such as energy performance. Deciding which way to orientate a building, and how much glazing will be used, may have a greater effect, over the life of the building, than a decision to use a particular type of insulation material.

Equally as important as the identification and selection of green materials is how those materials are used. It is possible to use the green materials inappropriately, and achieve no significant environmental benefit. An 8,000 square foot home for example, may be constructed using green materials with low environmental impacts, but the quantities used may result in greater overall impact then a smaller home constructed with conventional materials.

Conversely conventional materials can be used in ways that will achieve environmental benefits. Foamed plastic insulation, a petrochemical derivative,

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SECTION 2
BUILDING ENVELOPE

METAL CLADDING

Various types of metal cladding are available.

At the higher end of the range are composite aluminum cladding panel systems. These are prefabricated systems with panels held in an aluminum extrusion. Panels can be solid aluminum but more typically are a composite with outer and inner aluminum skins separated by a plastic core.

Systems available in the Lower Mainland are typically manufactured in the US. Fabrication of panels and of many of the sub components of the systems takes place locally.

ALUMINUM CLADDING PANELS

Material Characteristics	*Durable cladding, minimal maintenance*
Raw Materials	*Aluminum (Bauxite)* *Core material - plastic*
Manufacturing Process	*Embodied energy 274 MJ / kg.*
Manufacturing Location	*Composite panel material typically manufactured in US. Panels fabricated in Lower Mainland using some locally fabricated components.*
Environmental Profile	*Material extraction impacts (Mining impacts, solid waste generation, run off from tailings, habitat loss)* *Significant energy use during manufacture.* *Aluminum is recyclable however the composite nature of the panels makes recycling difficult.*

A second type of metal cladding in common use is profiled steel cladding. Originally used on industrial buildings, prefinished steel cladding is becoming more common as a cladding material for commercial buildings. Prefinished steel cladding is discussed in more detail in the roofing section.

Key Strategies to Reduce Environmental Impacts

- Greatest environmental benefit can be achieved by selecting durable, long-life cladding materials, and using them in conjunction with other durable materials to provide long-life assemblies.
- Life cycle environmental impacts can be further reduced by selecting materials with low maintenance requirements.
- If long-life cladding material cannot be used, environmental impacts can be reduced if the cladding can be replaced without damaging other assembly components.
- Consider salvaged cladding material
- If wood products are used, specify certified products in order to encourage sustainable forestry practices.
- Select locally produced siding

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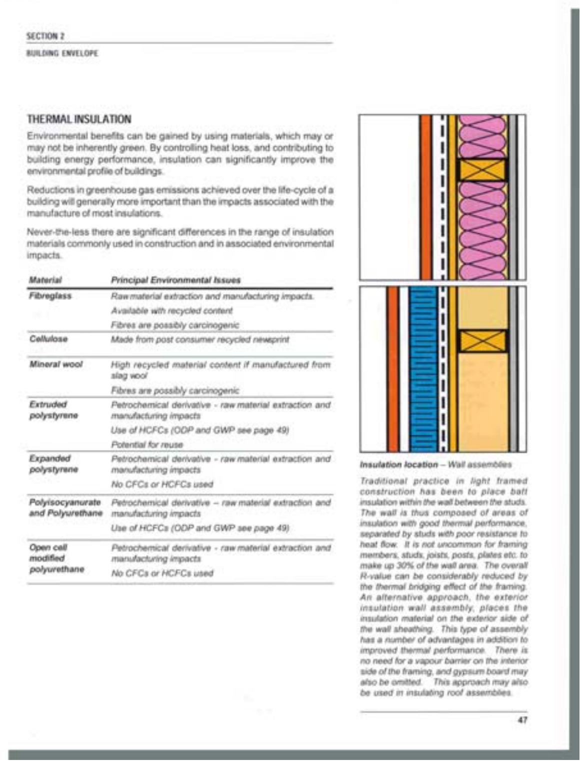

SECTION 2
BUILDING ENVELOPE

THERMAL INSULATION

Environmental benefits can be gained by using materials, which may or may not be inherently green. By controlling heat loss, and contributing to building energy performance, insulation can significantly improve the environmental profile of buildings.

Reductions in greenhouse gas emissions achieved over the life-cycle of a building will generally more important than the impacts associated with the manufacture of most insulations.

Never-the-less there are significant differences in the range of insulation materials commonly used in construction and in associated environmental impacts.

Material	***Principal Environmental Issues***
Fibreglass	*Raw material extraction and manufacturing impacts.* *Available with recycled content* *Fibres are possibly carcinogenic*
Cellulose	*Made from post consumer recycled newsprint*
Mineral wool	*High recycled material content if manufactured from slag wool* *Fibres are possibly carcinogenic*
Extruded polystyrene	*Petrochemical derivative - raw material extraction and manufacturing impacts* *Use of HCFCs (ODP and GWP see page 49)* *Potential for reuse*
Expanded polystyrene	*Petrochemical derivative - raw material extraction and manufacturing impacts* *No CFCs or HCFCs used*
Polyisocyanurate and Polyurethane	*Petrochemical derivative – raw material extraction and manufacturing impacts* *Use of HCFCs (ODP and GWP see page 49)*
Open cell modified polyurethane	*Petrochemical derivative - raw material extraction and manufacturing impacts* *No CFCs or HCFCs used*

***Insulation location** – Wall assemblies*

Traditional practice in light framed construction has been to place batt insulation within the wall between the studs. The wall is thus composed of areas of insulation with good thermal performance, separated by studs with poor resistance to heat flow. It is not uncommon for framing members, studs, joists, posts, plates etc. to make up 30% of the wall area. The overall R-value can be considerably reduced by the thermal bridging effect of the framing. An alternative approach, the exterior insulation wall assembly, places the insulation material on the exterior side of the wall sheathing. This type of assembly has a number of advantages in addition to improved thermal performance. There is no need for a vapour barrier on the interior side of the framing, and gypsum board may also be omitted. This approach may also be used in insulating roof assemblies.

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Sample Pages