

# Designing With the Environment

In 1992, the Ministry of the Environment's Waste Reduction Office brought together a group of diverse stakeholders representing many facets of the Ontario Construction Industry to form the CONSTRUCTION AND DEMOLITION (C&D) WASTE REDUCTION STRATEGY TEAM. The Design Professionals Waste Reduction Subcommittee identified that an Environmentally Responsible Design Guide was a worthy task for the Strategy Team to pursue.

A working group was established, led by Antony Polyzotis of the Association of Registered Interior Designers of Ontario, to develop this product. The Consulting Engineers of Ontario, Construction Specifications Canada, Ministry of Government Services, Ministry of the Environment, Ontario Association of Architects and the Ontario General Contractors Association all contributed to the development of this guide.

## Our Environmental Commitment

Through thoughtful consideration, create built environments that will optimise human health and safety without compromising local and global environments. This effort promotes the synergy between natural and manmade environments.

## Why the Guide?

Designing With The Environment has been developed to draw attention to emerging issues that will encourage the incorporation of procedures that will ensure optimum responsibility in the planning and specifying of all built environments. Our building codes are in the process of revision. The Waste Reduction Office of the Ministry of the Environment is dispelling the notion of "waste" and is promoting the diversion of secondary material resources from disposal. In conjunction with these and other initiatives, we are working towards environmentally responsible approaches to the design process.

Designers must lead the shift towards improved practices and change the character of demand in anticipation of regulated change. As environmentally conscious designers, we need to evaluate the following in our efforts to promote environmental integrity in our society. Our environmental decisions should include, and not be limited to, product specifications, tenders and contract award decisions.

This Guide is by no means absolute. Its primary function is to foster environmental awareness and promotes the examination of design options that may be available. Cost implications in environmental design have been intentionally excluded in order to encourage cost benefit analysis of project design, as well as, material and product specification.

## Considerations for Environmentally Responsible Design

Project pre-design, including space planning and architectural programming, is often completed when an organisation is in a state of flux and a specific site has not yet been chosen. There are many opportunities at this stage of the project to incorporate environmentally sensitive design goals and objectives, which will guide the subsequent design, and construction of the facility. Key pre-design issues should focus on energy requirements and user/building/technology interface to minimise energy consumption and maximise the individual user's environmental control. It should also be possible at this stage of the project to identify, in round numbers, the cost implications of these decisions, both from a capital and operating cost perspective, in order to facilitate informed choices.

The solution to environmental problems in facilities is as multi-dimensional as is the problem itself. No one single approach can be proven ultimately effective and similarly no one individual can resolve the problem alone. Designers, architects, engineers, facility managers, cleaning staff, management and labour must all be educated to identify where they can make a difference.

## **Pre-Design and Facility Requirements**

- Is the project necessary and have alternatives been explored?
- Does the facility need to be built or are there facilities that can be adapted for re-use?
- Can the program address issues to reduce overall building energy requirements?
- Specify how heat/energy can be recovered and recycled?
- Identify site selection criteria which minimises environmental disturbances such as modifying the existing site features, scenic vistas and threatens rare or delicate ecosystems?
- Create a relationship between site selection and the existing transportation network to maximise the use of existing infrastructure?
- Create both vertical and horizontal relationships in order to reduce the size of the building envelope and discourage consumptive building designs?
- Specify an environmentally appropriate performance level for building materials and systems?
- Identify composting and recycling opportunities and indicate the potential volumes and types of materials generated by the project?
- Can the major energy requirements of the building be satisfied using sustainable/renewable energy sources?

## **Site Selection**

- Is the site environmentally appropriate for development?
- Does the site provide opportunities for sustainable development design features?
- Has there been adequate site testing, including hazardous materials, to determine if the site can be safely developed?
- Does the facility respond to local environmental conditions such as prevailing winds and weather systems?
- Does the site have any characteristics appropriate for maximizing passive/active solar opportunities?
- Have the design and technological options been explored to minimize sanitary loads and storm water management?
- Are there opportunities for on-site treatment of wastes and if not, how does the development affect local sewage treatment facilities?
- Does facility programming incorporate design features for composting and recycling?

## **Building Design and Orientation**

- Have you explained to your clients the possibilities, costs and benefits of including environmental solutions within their programs?
- Can the facility be easily adapted for other uses over time? Has the core to window distance been optimized for maximum illumination?
- Does the building design lend itself to inclusion of exterior lighting shelves?
- Have you considered operable windows?
- Has the building been designed to facilitate composting and recycling?
- Have you considered eliminating the basement?

# Design Development

## Building Material and Product Selection

- How much embodied energy (resource extraction, processing, material density, transportation) does the material account for?
- Have you done a life-cycle costing analysis of major materials and explored options.
- Are all the features of the product necessary?
- Does the product contain any banned, exotic, endangered or nonrenewable materials?
- Does your choice of material affect indigenous and local economies?
- Does the product contain hazardous materials which may require special disposal following use?
- Have you selected materials that minimize off-gassing either during or after installation?
- Has modular design been incorporated?
- Is the material or product designed to be durable?
- Is the product reusable, reconditionable or recyclable?
- Do different construction techniques facilitate ease of material separation after original use?
- How much maintenance is required?
- How energy intensive is maintenance?
- Can you minimize toxic or high volatile organic compound (VOC) solvents needed for cleaning and maintenance?
- Does the material need protective coatings or treatments that may be hazardous to health?
- How is delivery, storage and handling of material minimizing waste?

## Gypsum Board

- Has design minimized excessive offcuts?
- Are products like By-Product Gypsum (BPG) and gypsum board with recycled content encouraged?

## Ceramic Tile

- Have you looked into tiles that incorporate recycled glass?

## Acoustic Ceiling Tiles

- Have ceiling tiles with recycled fibreglass or cellulose fibre been considered?

## Wood

- Have you used wood harvested by sustainable forestry?
- Are you specifying wood containing natural preservatives as opposed to chemically treated wood?
- Have you used solid wood instead of plywood and particleboard which off-gas formaldehyde?
- Have you specified wood substrate material that off-gases less than others?
- Have you sealed exposed wood products which off-gas?

## Resilient Tile Flooring

- Is the floor recyclable or contain recycled content?
- Do you know about attributes of linoleum flooring?

## Carpet

- Have you considered wool versus petrochemical based yarn?
- Is product data concerning off-gassing?
- Does the performance criteria of “treated or guarded” carpet exceed that of non-treated considering the degree of additional off-gassing?
- Is there recycled content in the carpet and underpadding?
- Can the product be reused, recycled, or composted locally?
- Is the product designed for low maintenance to reduce the “sink factor”?
- Can the carpet be installed by a dry laying method (tackers and pad) instead of by glue down?

## Paints and Finishes

- Are you using latex paint where possible in lieu of solvent based paint?
- Are you specifying higher grade solvent based paints low in VOC's?
- Have you used paint that meets or exceeds Environmental Choice Program Guidelines?
- Have you specified naturally formulated shellacs and varnishes instead of urethane or other high VOC finishes?
- Are excess paints mixed and used where colour is not important?

## Engineering

- Does your design address long-term durability requirements and whole life costing from construction through ongoing maintenance to ultimate demolition?
- Does your design accommodate modular design and “as manufactured dimensions” of manufactured products?
- Have you considered using BUILD GREEN products? Are recycled materials used as substitutes for granular fill and base materials?
- Are fly ash and slag incorporated into concrete specification?
- Does asphalt paving incorporate recycled materials?
- Has BUILD GREEN form work or reusable form work been considered?
- Has salvaged masonry such as concrete block or brick been considered?
- Have products containing recycled steel been used?

## Energy Efficiency

- Is the equipment and system designed to be energy efficient?
- Is the equipment designed for easy maintenance and repair?
- Is the required maintenance environmentally harmful?

## Mechanical

- Have you excluded the use of hazardous chlorofluorocarbons (CFC's) for the cooling system?
- Is the containment of CFC releases promoted?
- What type of fuel is used for heating?
- How is heat transferred throughout the building?
- Have you sub-metered the water system to aid leak detection?
- Are vandal resistant facet aerators (0.5 litres per minute flow) specified for public/staff washrooms?
- Have urinal flush tanks been fitted with sensor controlled flushing devices?

## Electrical

- Have wiring layouts taken energy consumption into consideration?
- Are energy efficient lighting systems used?
- Have the transformers been tested for electromagnetic radiation?
- Have wiring layouts taken electromagnetic shielding into account?
- Indoor Air Quality (IAQ)
- Are you aware of sources of off gassing?
- Are there any studies or tests the manufacturer has conducted for off gassing of their products?  
Do you have copies of results?
- If there is off gassing, do you know where to find information related to the acceptable legal limits and associated health hazards?
- Have the negative effects of off gassing been considered in HVAC design?
- Have standards met or exceeded ASHRAE 90.1 (energy management) and ASHRAE 62 (indoor air quality) in the HVAC system design?
- Can the air be distributed more effectively?
- Can you improve ventilation by increasing the volume amount of fresh air?
- Are ventilation rates aligned with room use?
- Have you considered zoning and individual climate controls?
- What measures have been taken for air filtration?
- Has the system been designed for ease of maintenance?
- Have air quality sensors been installed?
- Are you aware of bacteria, mould and fungus sources?
- Are raised floors designed into the building?
- Can you identify indoor air quality issues and propose appropriate actions (i.e. IAQ consultant/  
Mechanical engineer)
- Have you considered administering an IAQ questionnaire?

## Landscaping

- Have drought tolerant plants and xeriscape landscaping been considered?
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- Have nitrogen fertilisers that are made from reclaimed waste products been specified?

## **Interior Space Planning**

- Have you considered demountable systems furniture?
- Have you considered the effect on airflow within the open office?
- Have you investigated biological air regeneration and purification using appropriate foliage?
- Have surfaces with higher light reflection values been considered?
- Do you know if the materials and products specified pose a health hazard to the occupants?

## **Specifications and Documentation**

- Have you written specifications to encompass the principles embodied in this document?
- Are you specifying products or services to meet or exceed standards and requirements of the Environmental Choice Program, Build Green Program, ASHRAE, NRC, CSA or other accredited programs?
- Can the manufacturer substantiate their environmental claims with appropriate documents and reports?

## **Manufacturers**

- What is the manufacturer/supplier's track record on environmental and safety issues?
- Does the manufacturer/supplier have an environmental policy statement?
- What waste reduction programs does the company have in place?
- Do they use recycled materials in the manufacture of their products?
- Have they been tested for toxicity and off gassing?
- Does the company refurbish reusable products?
- What solid, aqueous or gaseous wastes are produced during manufacturing?

## **Packaging**

- Can the packaging be eliminated altogether?
- Is minimal packaging used?
- Are items packaged in bulk or individually?
- Is the packaging reusable?
- Is the packaging material easily recyclable?
- Does the packaging contain recycled content?
- Does the manufacturer reuse or recycle their packaging/shipping materials i.e. pallets?
- Do they ship using blanket wrap?
- Can materials be substituted which are more environmentally benign?

## **Construction & Demolition**

### **Waste Management**

Have you asked prospective contractors for a Waste Management Plan with their quotations that will include:

- methods for reducing waste?
- cost associated with the recovery of reusable building materials and anticipated revenues from their sale?

- methods for collecting, separating and recycling waste materials and packaging?
- list of haulers and disposal destinations for waste and recyclable materials?
- how hazardous waste will be handled, disposed or recycled?
- proposed method and procedure for educating workers and subcontractors in order to ensure adherence to the Waste management Plan?
- other environmental options available?

## **Construction Waste**

- Is excess material separated at source for reuse or recycling?
- Is excess paint properly stored for reuse, recycling or disposal?

## **Demolition Waste**

- Can building materials be reused or recycled?
- What is the cost associated with the disassembly of building materials, their anticipated revenues or reduced disposal costs versus more traditional demolition practices?

## **Facility Maintenance**

- Housekeeping and Maintenance
- Do you have scheduled cleaning and maintenance programs?
- Have you substituted solvent-based cleaning solutions for less hazardous products?
- Have organic solvent-based cleaning solutions been substituted with detergent and water.
- Are cleaning agents biodegradable and/or phosphate free?
- Are cleaning and maintenance products purchased in bulk?
- Are cleaning and maintenance products purchased in containers that are reusable, refillable, or recyclable?
- Do you keep cleaning solutions and other chemicals sealed and stored in well-ventilated areas?
- Are carpets vacuumed frequently to avoid secondary airborne dust?
- Did you know vacuum filters redistribute finer particulate into the air?
- Have you considered using water chamber vacuums in order to reduce dust?
- Is the cleaning staff using feather dusters that redistribute dust or using moistened clothes that collect dust?
- Are air ducts cleaned regularly?
- Maintaining Air Quality In Existing Facilities
- Is air circulation controlled and monitored to ensure that the entire facility is properly ventilated to a minimum ASHRAE 62 Standard?
- Have you initiated proactive air quality testing and environmental audits to avoid potential problems?
- Are their scheduled cleaning and/or replacement of the HVAC system's high efficiency air filters?
- Do qualified personnel who understand the HVAC system do air balancing?
- Are air intake grills inspected for obstructions?
- Do air grills exhaust into the ceiling plenum, which only dilute and disperse contaminants?
- Are high efficiency exhaust fans used in photocopy areas, smoking rooms and other areas where adhesives or solvents are used?

- Can equipment such as photocopiers be located in a separate area?
- Have you selected indoor plants that remove airborne chemicals such as benzene, formaldehyde and trichloroethylene?
- Is your human resources department correlating absenteeism, illness, accident and employee turnover data to building ecology and ergonomics?
- Have staff been made aware of potentially hazardous substances and processes?

## **In Your Office**

- Do you practice what you preach?
- Do you work with a client organisation's environmental representative to discuss their policies and requirements?
- Is there designated staff responsible to keep your office updated on relevant environmental issues?
- Are you environmentally responsible?

## **List of References and Sources**

- BEPAC September 1991 (Building Environmental Performance Assessment and Certificate program)
- BREEAM Version 1/90 (Building Research Establishment Environmental Assessment Method)
- G.I.P.P.E.R.'s Guide to Environmental Purchasing
- Guiding Principles for Environmental Labelling & Advertising American Institute of Architects (AIA) Environmental Resource Guide
- Greater Toronto Home Builders Making a Molehill Out of a Mountain II - Implementing the Three R's in Residential Construction
- Preliminary Study of Construction and Demolition Waste Diversion
- Constraints & Opportunities - MOE Waste Reduction Office
- Work Place Guide - Harmony Foundation