
# Alberta Environment
# Alberta Construction, Renovation and Demolition [CRD] Waste Advisory Committee

## Policies, Guidelines and Specifications Database

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Table of Contents i

# Executive Summary

This report is intended to assist the activities of the CRD Waste Reduction Advisory Committee. It surveys policies, guidelines and specifications in Alberta affecting CRD waste reduction, identifies sponsors of CRD projects and assesses the level of awareness of CRD activities in Alberta. It examines the literature for good examples of specifications and policies from other jurisdictions that might serve as models for Alberta and to identify barrier and opportunities to the reduction of CRD waste in Alberta.

Telephone surveys of Alberta firms and individuals involved in CRD waste activities revealed little awareness of CRD waste reduction activities and the lack of and inconsistent application of policies, guidelines and specifications to this area of the construction industry.

Literature searches for CRD policies, guidelines and specifications in other jurisdictions revealed some good examples of partial initiatives in this area, but no examples of comprehensive, self-sustaining CRD waste reduction systems directly applicable to Alberta circumstances.

Aspects of the construction industry that make it unique among other economic sectors for opportunities for policy change to waste reduction activities were examined. These included the stages of the building life cycle and the distributed nature of the building decision making process, and the barriers and opportunities of different building sectors and the effect of scale.

The report concludes that the adoption of key conditions could create a self-sustaining, self-regulating process of CRD waste reduction activity in Alberta that properly pays for the new activities and responsibilities required.

It recommends the adoption of a number of related strategies in the following areas to achieve this goal:

- Value-base Proponents
- Legislative Support
- Private Sector Infrastructure
- Cost Documentation of Current Work
- Uniform Work Practices
- Good Information Exchange
- Disposal Cost/Tonne and Haulage Costs

It contains a database of sources of information about policies, guidelines and specifications currently in use in Canada, the United States and internationally.

# 1.0 Introduction

Alberta Environment engaged Manasc Isaac Architects Ltd. to conduct a study of Policies, Guidelines and Specifications to support the activities of the Alberta Construction, Renovation and Demolition [CRD] Waste Advisory Committee in reducing the amount of CRD waste being landfilled in Alberta.

The study tasks included:

- The identification of institutional barriers in municipal and provincial policies and guidelines in Alberta preventing the reduction of construction generated wastes in Alberta.
- The identification of sponsors of large public and private sector CRD projects in Alberta.
- The identification of examples of progressive policies, guidelines and specifications used in other jurisdictions that promote CRD waste reduction.
- The evaluation of opportunities to adopt or adapt progressive strategies successfully used in other jurisdictions.
- The preparation of a report summarizing the status of commonly used CRD specifications in Alberta and the presentation of the results of the study to the CRD Waste Reduction Advisory Committee.

# 2.0 Methodology

To do these tasks, a range of individuals and organizations in Alberta, across Canada and in other countries were contacted to inquire about their CRD waste related policies and activities and the resulting effects. This research included:

- Telephone interviews with individuals and organizations affected by or involved with CRD waste management strategies, and
- Literature searches for relevant material on CRD policies, guidelines and specifications.

***Interviews***. Initially, a standard questionnaire [See Appendix] was used to ascertain the level of knowledge that respondents had of CRD waste reduction strategies and the level of activity in CRD waste reduction that they were involved in. Contacts [See Appendix] included representative organizations in different construction sectors in Alberta:

- Large construction firms
- Residential construction firms
- Demolition and deconstruction contractors
- Architectural and engineering firms
- Large property management and development firms
- Specifications and standards organizations

- Large public sector sponsors
  - Provincial
  - Municipal
  - Federal
  - Universities

The telephone surveys, however, produced results inconsistent with known activities in the province. Generally, two types of inconsistencies were found.

1. In some cases, CRD waste reduction, re-use and recycling activities were not recognized as such by the individuals contacted.

For example, Environment Canada conducted a viability study of on-site recycling of masonry waste during the construction of the Timms Centre for the Arts at the University of Alberta in 1995, but University staff were unaware of this.

In a second example, interviews with a specialist materials recovery firm highlighted the success of recycling and resale of CRD waste materials on significant projects [TD Tower re-cladding, Edmonton; Meadowlark Mall, Edmonton, various City of Edmonton renovation projects]. Interviews with the architects, engineers and project managers for these projects indicated an uneven level of awareness of these activities.

In a third example, interviews with several people within one large engineering company with a good reputation for CRD waste management indicated different levels of understanding of CRD waste management issues. Different actions based on decisions of different parts of the company resulted. On a major industrial project in a remote area, steel was transported at cost to the project for recycling. Cardboard packaging was landfilled at cost to the project. These decisions were based on a perceived value of the material; no economic analysis was done to confirm the actual value of these materials.

2. Guidelines and specifications affecting CRD waste management appeared to be applied in an ad hoc and inconsistent fashion.

For example, the National Master Specification [NMS] is the principle source of draft specifications for building designers in Canada. Public Works Canada supports the development of the NMS by providing a Secretariat to draft the specifications. Public Works Canada has undertaken a policy of integrating sustainable development principles into all the NMS sections. However, "The NMS is a construction document designed to help those in the industry who are involved in the specification writing process". There is no requirement to use the NMS or the sustainable options it contains. It "contain(s) information intended to assist specification writers in making the appropriate choices of materials, systems and procedures". The choices still reside with the individual specifiers and will be affected by the individual values, training and experience of each and sometimes those of the owner.

As a second example, The City of Edmonton has tried to develop a standard approach to the removal of materials from buildings undergoing renovation. However, in order to complete projects on time and on budget, the City will permit contractors to waste all demolition materials if:

- The contractor objects due to site access and perceived liability concerns.
- The schedule does not provide enough time to find and employ trained personnel to remove materials from the project.
- The materials to be removed are not perceived to have a market or sufficient value.

Specifications are developed on a project by project basis and are stored in the project file. The specifications are not consolidated into a master file, easily available for the next project.

As a third example, interviews with federal government personnel indicated that CRD waste management strategies [guidelines and specifications] were used not comprehensively, but rather on the basis on where success could likely be found. In the Atlantic Region, reclamation of former U.S. military bases presented workable opportunities, where up to 80% of materials formerly directed to landfills is now being diverted. The Quebec Region had a few examples of CRD waste diversion to recycling. Southern Ontario provided more opportunities for CRD waste diversion from federal government projects, with more of the recycling market components in place. In the Western Region, little work was being done. In Winnipeg, a pilot project is underway on a federal renovation project.

Therefore, to obtain more meaningful information about CRD waste related activities in Alberta, another approach was needed. More detailed telephone interviews were conducted with fewer contacts in each construction sector. Interviews were started with the standard survey questions and then pursued in more depth to elicit the specific barriers and opportunities perceived by that sector to CRD waste reduction to uncover the key drivers of decisions [proxies for policy].

***Literature Review***. The purpose of the literature review was to determine:

- Where CRD Policies, Guidelines and Specifications were to be found,
- What these documents contained, and
- What evidence existed of the results achieved [i.e.: barriers and opportunities].

The literature reviewed was found through:

- Library searches,
- Internet searches, and
- Referrals from interviewees.

The results of the interviews and literature reviews were analyzed and synthesized into the concise format following.

# 3.0 Results

At the root of the question about why something happens or not is the idea of value, what is thought to be important. This investigation has indicated the effect of different values at work in the building cultures of different countries and locations.

| Approach | Location | Value | Key CRD Concepts |
|---|---|---|---|
| Most Integrated | Europe | Legislation | Question not if, but how much to Reduce, Reuse and Recycle |
| | Canada | Collaborative Action | |
| | United States | Individual Initiatives | Top & bottom driven, gov't actions disconnected from building owner or developer actions |
| Least Integrated | Australia | State decides to act first, then sorts out the details with industry | Top driven, international protocol and Memorandum of Understanding to develop industry initiatives |

## 3.1 Barriers to CRD Waste Reduction

In the Alberta situation, the limited market for labour and materials is perceived as a barrier over government policy. The market or cost component [an implied policy] is always identified over [explicit] government policy. The exception is the low cost of landfill Class III and dry inert material disposal [explicit policy], which was identified by some as a barrier to reuse of materials.

For example, interviews with architects [Stantec], engineers [GKO], contractors [EnviroBuild] and building owners [City of Edmonton] revealed consistent responses to the question of perceived barriers to reduction of the CRD waste stream. These barriers included:

- Lack of trained available labour to handle waste materials within the project time frame [Stantec, EnviroBuild, City of Edmonton].
- Lack of readily available space to sell materials from or to remove materials to at a lower cost than disposal [Stantec, City of Edmonton].
- Lack of re-furbishers or handlers to check over materials for intended re-use, to provide for re-certification as being of adequate quality for re-use.

When Alberta contacts were specifically asked about Government policies, regulations and guidelines as barriers to CRD waste reduction, none saw this as a major concern. When prompted about the effect of landfill costs on decisions made, respondents thought of haulage costs rather than landfill costs as influencing their decisions to divert materials or not. Rather, they said that if they believed that a CRD material [metal, glass block, old brick, concrete] had a residual value, they would be more likely to seek re-use or recycling opportunities, even if there was not net return to the project [e.g. GKO industrial projects].

In one specific example, engineers decided to pay for the hauling of steel from a remote site for recycling because they perceived that the steel had a residual value. On the same project, the same engineers decided to pay for the expansion of a municipal landfill to accommodate waste cardboard packaging [creating local employment and investment in regional infrastructure as a by-product] because they perceived that the cardboard didn't have a residual value. In neither case was the actual cost of CRD material removal options actually calculated. The decisions were made on the basis of the perceived value.

## 3.2 The Design and Construction Process

***Building Life Cycle Stages.*** Buildings can be thought of as having a lifecycle, with a beginning and an eventual end.

An important feature of the life cycle of a building is the distributed nature of the decision making process and the number of steps that a building project or building passes through from start to finish.

Few, if any, of the participants, either as companies, organizations or individuals, are involved continuously throughout the life cycle of a building. As a result, there is a very strong likelihood that strategies and reasons behind many building construction and operations decisions will not be properly documented and communicated to the next person in the decision chain. This loss of continuity of information and decisions may result in the inefficient operation of the building and increased operational cost. This loss of continuity can also result in insufficient maintenance of a building system and the increased rate of decay of the building fabric.

A Building Life Cycle [for all forms of building] could look like the following. In each stage, different teams of people, often in isolation from the other stages carry out different goals and objectives. Even in the same life cycle stage, different participants are often required to carry out their different responsibilities as described in contracts.

| **Number of Decision Makers Involved** | Pre-Design & Facility Requirement Stage | Planning, Design Development Stage | Specification & Documen-tation Stage | Construction, including Demolition and Renovation Stage | Facility Operation & Maintenance Stage | Decommis-sioning Stage |
|---|---|---|---|---|---|---|
| 40 | | | | | | |
| 35 | | | | | | |
| 30 | | | | | | |
| 25 | | | | | | |
| 20 | | | | | | |
| 15 | | | | | | |
| 10 | | | | | | |
| 5 | | | | | | |
| | 1 | 2 | 3 | 4 | 5 | 6 |

***Building Life Cycle Stages***

1. Pre-Design and Facility Requirements
2. Planning, Design Development
3. Specification and Documentation
4. Construction [can include Demolition and Renovation]
5. Facility Operation and Maintenance
6. Decommissioning [can include Renovation, Deconstruction or Demolition]

The Decommissioning Stage represents the end of one use of a building and the point at which choices are made about the method of complete removal or reconditioning of a building for new uses. The following charts concisely illustrate the results of each stage of the building life cycle and the opportunities for policy change.

| **Building Life-Cycle Stage** | **What would it take to improve CRD Waste Reduction?** | **Areas where this is happening** |
|---|---|---|
| **1. Pre-Design and Facility Requirements** | • Legislation<br>• Perception of benefit to Building Owners (owner's policies)<br>• Awareness of implications of CRD waste reduction<br>• Knowledge gained from decommissioning informs new design | Ontario<br>Australia<br><br>Europe<br><br>Europe |

***Outcome:*** The Building Owner, working within the bounds provided by legislation or society, establishes the parameters of what the successful completion of this specific building will look like: capital budget, schedule for completion, appearance, performance, quality. The Building Owner establishes the conditions to be met and the resources available to meet them with.

At each subsequent decision point, the options and actions are constrained by the actions and decisions taken in the previous stage.

***What would it take to improve CRD Waste Reduction?*** More than one factor may be required for a change of CRD waste management behaviour to take place, at this early planning stage.

For example, in Ontario, provincial legislation requires a building owner, under specified conditions, to do the following on a project:

- Conduct a CRD waste pre-audit.
- Make a plan incorporating CRD waste reduction.
- Perform site separation of waste materials.

In spite of this legislated requirement, the success of CRD waste reduction activities is uneven across the Province. Some geographic areas, such as a 60-km radius around Ottawa, consistently achieve better results than do others. This indicates that while building owner may be required to take action to reduce CRD waste, this is not a sufficient condition for success.

The difference in the Ottawa area seems to be the leadership of key individuals in government [Royston Gordon] and the private sector [Vince Catelli]. They find ways to make things happen by understanding how to use the available policy tools, seeking out and organizing the available market resources and continuing to seek solutions to the technical and economic problems that continually arise throughout the course of a project.

| Building Life-Cycle Stage | What would it take to improve CRD Waste Reduction? | Areas where this is happening |
|---|---|---|
| **2. Planning, Design Development** | • Building owner direction to reduce CRD waste<br>• Guidelines/Protocols to reduce CRD waste<br>• Access to information on alternatives to calculate cost and savings to project<br>• Best practice/design for deconstruction<br>• Knowing that recycled, re-used materials will<br>  • Perform/function to a standard [liability]<br>  • Be available for use<br>  • Be removable by marketplace | Alberta<br>NMS/Australia<br>Australia/<br>North Carolina<br>US/AIA<br>US<br>Ottawa<br>Ottawa/BC |

***Outcome:*** The design concept of the site and building that fulfils the parameters established in the Pre-design and Facility Requirements Stage is illustrated by the end of this stage

The Design Consultant Team consists of the Architect, Landscape Architect, Structural, Mechanical, Electrical and Civil Engineers and other specialists required to solve the problems posed by the building owner's requirements.

In this stage, the Design Team formulates strategies for building in discussion with the building owner and users of the proposed building. Embedded in these strategies are explicit or implicit approaches to CRD waste reduction. Use of CRD waste "best practices" at this stage could permit reduction of the waste generation process and relocation of some waste generation activities away from the construction site to the factory where a product can be shop cut to fit.

The Design Team produces a set of drawings and outline specifications that shows how the building owner's minimum success requirements have been solved.

***What would it take to improve CRD Waste Reduction?*** Lacking a public policy framework explicitly requiring the reduction of CRD waste, an Alberta Design Team will look to the building owner's requirements for direction. The building owner, perceiving a benefit, perhaps of good public image or financial gain, from CRD waste reduction practices, may require the use of CRD waste reduction strategies by the Design Team. Most building owners will not provide this direction. Few building owners seem to be aware that CRD waste management is an issue for their attention.

European building owners and builders face a situation somewhat different from that in Alberta. Unlike here, where an estimated 80% of buildings required by 2020 have yet to be built, Europeans have built up a large stock of buildings over the last 500 years. New uses must be fit into old buildings to a much greater extent than in Alberta. Much waste material will be generated in the dense settlement area by many renovation projects. The management of "mass flows" is a subject of intense study by European governments and universities. Much useful information is being developed from current projects to feedback to the design and pre-design stages to better inform these critical decision making stages.

Three examples of this effort are found in the Conference Proceedings of the Green Building Challenge, Vancouver 1998.

In Germany, the Institute for Industrial Building Production at the University of Kalsruhe conducted a study of "Sustainable Management of Buildings and Building Stocks". This was to quantify and model the amount of building materials found in the German building stock and the flows of new and waste materials required to maintain the building stock in a viable state and in a sustainable fashion.

In Denmark, the Danish Building Research Institute conducted a study of the "Inclusion of Life Cycle Assessment of Materials in Green Building Performance" to examine how a more comprehensive system of cost accounting of building performance and environmental effects would change the construction and CRD waste decision making process.

In Sweden, several studies were reported that analyzed the methods and practices of waste flow accounting to improve local environmental management practices and policies in the City of Stockholm.

The values underlying the European studies seem to be both environmental and economic. On the one hand, the studies attempt to measure the impact of further resource extraction for replacement building materials on the environment. On the other hand, the studies try to assess the economic value of the in-situ building materials as a resource to be extracted and reprocessed into further building materials.

| Building Life-Cycle Stage | What would it take to improve CRD Waste Reduction? | Areas where this is happening |
|---|---|---|
| **3. Contract Documents [Drawings and Specifications]** | • Green model specs<br>• Specification which can be implemented in the local market<br>• Successful local market for specified tasks | Federal Gov./USA-North Carolina<br>USA-North Carolina; Vancouver, Harvey Barracks<br>USA-King County; Vancouver |

***Outcome:*** The key result of this stage is the creation of the contractual instructions to the building and site contractors who will execute the work. It is the Design Team's translation of the design concept into measurable [for cost estimation] and legally enforceable requirements for the building.

The documents at this stage have evolved into a highly detailed set of drawings and specifications describing the size, location, configuration, type and quality of building materials, components and systems. In addition to the specific technical requirements of building parts, there are requirements describing the expected behaviour of the contractors on site and of the performance of the building in operation.

***What would it take to improve CRD Waste Reduction?*** In Canada, "greened" model specifications, such as those developed by Public Works Canada for the National Master Spec. [NMS], are voluntary guidelines for changing the behaviour of contractors on site. Some of roughly 900 available specification sections, such as Section 02250 – Demolition, have been specifically rewritten to facilitate CRD waste re-use and recycling. They instruct the contractor how to site-separate and store waste so as to keep it from becoming contaminated, to retain the value of the different materials for re-use and recycling. The sections also instruct the contractor to obtain re-use and recycling services where those services are available in the location of the work.

While some CRD expertise is codified in specifications and is transferred to projects in contracts, much innovation and change to a higher standard of performance is developed and retained within the design teams on a project by project basis. This information tends to be retained within the project file or the expertise of the professionals directly involved and to go no further.

Some building owners have developed specifications that respond to local market conditions. Alberta Infrastructure advises contractors of local recycling opportunities in Edmonton and Calgary, but in a limited and voluntary way. The Architectural Clearing House is pointed out as a source for re-cycling services; however, the specification permits this to happen if the specifier chooses to do so. No criteria for making this choice are given.

The City of Edmonton has developed a process for sequentially scavenging and offering a limited range of materials for recycling, based on the local ability to sell materials rather than landfill them. The choice to do this rests with the City project manager who

decides if there appears to be sufficient time in the project schedule, sufficient value in the recovered material to make the effort worthwhile and sufficient space on site for the site sorting and removal activities to happen.

Also in Alberta, a small number of private companies have developed the expertise to audit and evaluate CRD waste materials in-situ to assess the viability of a re-use or recycling effort. Among them are:

- EnviroBuild Edmonton
- The Architectural Clearing House Edmonton
- Wearmouth Canada [1951] Ltd. Calgary
- K-LOR Contractors Services Ltd. Calgary

The Defence Construction Canada [DCC] request for proposals for the demolition of the Harvey Barracks in Calgary contained a specification requiring a waste reduction plan to divert non-hazardous materials from landfill and the tracking and reporting of the flows of materials to recycling or disposal facilities.

Elsewhere in Canada, the City of Vancouver sponsored the development of a model specification for site CRD waste management and a professional development program for designers to assure its correct use. Use of the specification is voluntary.

In the United States in particular, considerable effort and success has been achieved in developing products containing recycled materials with assured levels of performance. Much work has been done to market these products and develop market acceptance of them.

For example, the United States Environmental Protection Agency [EPA] produced a document titled “EPA Comprehensive Procurement Guidelines, 1997 Buy-Recycled Series, Construction Products” to assist designers and builders with specifying and finding construction materials with recycled content. The “Whole Building Design Guide” is a US Government effort to collect comprehensive design guidelines in one reference. The Department of Energy produces the Sustainable Building Technical Manual that provides mostly background information on green building areas, including CRD waste management. This is specific to US markets and may not apply in Alberta.

At the County level, the Triangle J Council of Governments is often cited as a leading example of local government efforts to develop policies, program, guidelines and specifications to manage CRD waste materials in a comprehensive manner. It is “a regional organization of the local governments in a six county area surrounding Research Triangle Park, North Carolina”. The Triangle J Council currently lists a model specification and 10 case studies on their web site of CRD waste management projects carried out with their assistance to show the range of strategies possible and the range of results achieved. The model specification can be customized to create contract conditions for a number of different approaches to CRD waste diversion.

At the City level, Austin, Texas is often cited as the most complete municipal sustainable building program in the United States. It runs the Green Builder Program, produces the Sustainable Building Sourcebook and promotes these efforts and local green professionals and events through its web site.

At the Non-Governmental Organization [NGO] level, the US Green Building Council has developed the LEED Building Rating System [Leadership in Energy and Environmental Design] to establish to promote green building practices. The LEED System assesses the environmental performance of buildings using measures to assess the downstream effects of building systems and materials. Included is a measure of the recycled content of building materials and a measure of the recycling potential of new building materials and systems. The US Green Building Council is a broadly based organization representing departments of the federal government, industry, universities and the design professions with a mutual interest in improving building performance in the United States.

The American Institute of Architects [AIA], a voluntary professional organization representing American architects, has developed the Environmental Resource Guide [ERG]. This large document is a significant source of information about the life cycle of major building materials and the secondary effects that each has on the environment.

At the industry level, various American industry representative bodies and individual industries, such as the steel, wood and carpet industries provide information to designers and specifiers to persuade them to choose a particular product on the basis of its environmental benefits. The steel and wood industries compete head to head for the provision of structural and interior partition materials on the basis of reduced waste and embodied energy advantages each claim. [The Wood Council of Canada produces case study comparisons of this sort to promote the use of structural wood in buildings].

Collins & Aikman Floorcoverings, Inc. is an example of the most innovative environmental concept developed for building materials to date in the United States. The entire carpet, fibre and backing, is recyclable. The purchase contract for the carpet includes the provision for the eventual removal of the carpet by Collins & Aikman for recycling and the provision of a new carpet, at a discounted price, containing recycled material. By viewing the worn out carpet as a resource to be mined from the building, the company has created an almost completely closed loop manufacturing process. The building owner, in effect, leases a flooring service from a company. The lifetime responsibility for the material remains with the producer. Much of the effort in the US towards the reduction of CRD wastes seems to be focussed on similar efforts to develop the technology to make similarly conceived materials and to develop the market to sell these materials to.

| Building Life-Cycle Stage | What would it take to improve CRD Waste Reduction? | Areas where this is happening |
|---|---|---|
| **Construction, Renovation, Demolition** | • Access to timely and cost effective market solutions<br>• Generally accepted CRD industry practices<br>• Sub-trade level cost structure to encourage CRD waste reduction<br>• Accountability for demonstrating CRD waste reduction<br>• Competitiveness | Ontario /Australia<br>Ontario/BC/ Calgary [homebuilders] Edmonton<br><br>Harvey Barracks / Australia<br><br>Harvey Barracks |

***Outcome:*** One key result of this stage is the execution of the construction, renovation or demolition contracts prepared in the previous stage. Another is the actual CRD waste generated.

In the execution of the work, wastes are produced in the factory and on site. Procedures for CRD waste reduction contained in specifications or available in the market place are carried out at this stage. Important information about actual field behaviour and the costs and revenues of CRD waste procedures can be obtained at this stage if an information recording, evaluation and analysis process is in place.

***What would it take to improve CRD Waste Reduction?*** Regardless of specified requirements for CRD waste reduction, if market mechanisms are in place and sufficient money can be generated from re-use and recycling activities, CRD materials will be diverted from landfills and sold as a material resource.

If generally accepted CRD waste handling practices were used throughout the industry, getting wider participation by all contractors in an industry sector would be easier. At present, every new contractor has to be trained from scratch to understand waste management practices. Also, with a 30% annual turn over rate of labour, the on-going requirement for training new personnel would be eased by standard procedures.

At present, labour costs are more important than material costs for many sub-contractors. Given a choice between doing a task that requires more time and less new material and one that requires less time but more material, the sub-contractor normally chooses the lower cost method: less time and more material [and more waste]. He is not rewarded for the less wasteful choice.

In the Australian WasteWise program, participating contractors agreed to measure their waste reduction performance to demonstrate their achievement of commitments made. This information became an important promotional tool for the sponsoring agency to use to promote the contractors and the aims of the CRD waste reduction program, gaining wider public understanding and support.

As a result of experience gained from the pilot projects, the Australian contractors won projects elsewhere partly on the basis of their CRD-related knowledge. One company was able to get the commission for construction of the Microsoft Headquarters Campus partly based on the strategies developed on pilot projects at home. Another was able to take their Australian experience of CRD waste reduction to Europe and use it to reduce their construction cost and successfully compete for work there.

The Harvey Barracks Demolition is a good local example of a contractor using CRD-related knowledge to win a competitive contract. K-LOR Contractors Services Ltd. evaluated the condition and value of the in-situ materials in military buildings to be demolished and developed an economical strategy to remove and market them. The estimated revenue for the sale of the recovered material was used to reduce the cost of demolition of the whole project, producing the lowest bid price and the award of the contract to K-LOR.

| Building Life-Cycle Stage | What would it take to improve CRD Waste Reduction? | Areas where this is happening |
|---|---|---|
| **Facility Operation and Maintenance** | • Operating cost [operational waste management by design, not refit]<br>• Design to make it easy to do the right thing [retro-fit]<br>• On-going maintenance and replacement costs [for retained salvage value]<br>• Awareness of residual value in building resulting from care and maintenance of facility | Hinton Government Centre<br><br>Audubon Society<br><br>Harvey Barracks/BC |

***Outcome:*** One key result of this stage of the building life is the economical and sustained provision of properly conditioned space for business or organization activities. This stage is usually the lengthiest period of a building's life, lasting decades if not centuries, for many types of building.

Failure to adequately provide for the operation and maintenance of a building will result in its premature failure. Unfortunately, a popular financial management technique involves the deferment of routine maintenance and replacement activities and costs when money is short for the operation of a business or when an owner wishes to remove money from a company in the short term. This often results in a failure of a building material or system and added scope of replacement activities and costs in the long term or the premature decommissioning of the building.

The longer a building can be maintained in operating condition with adequate on-going maintenance attention, the longer the building materials and systems are maintained in place and kept out of the building material waste stream or the better condition when put on the market for resale [Harvey Barracks].

***What would it take to improve CRD Waste Reduction****?* The Action on Waste case study of the Harvey Barracks project noted that the high standard of maintenance practiced on the buildings "likely facilitated the sale of the items" recovered from the building deconstruction.

The corollary of this observation is the inclusion of an objective for the operations and maintenance activity of a building that aims to leave the material in a building in a state suitable for re-use or recycling. This suggests that the design and operation of a building include the necessary provisions for the disposal or renewal of the building at the end of its design life.

| Building Life-Cycle Stage | **What would it take to improve CRD Waste Reduction?** | **Areas where this is happening** |
|---|---|---|
| **Decommissioning**<br>[decision making process – starts with pre-design again], can include Renovation, Deconstruction or Demolition Work | • Building owner policy, legislation<br>• Cost saving<br>• Environmental ethic of reducing CRD waste<br>• Knowledge gained from decommissioning informs new design | Ontario, Vancouver<br>Harvey Barracks<br>Federal Gov.<br><br>Europe, Vancouver |

***Outcome:*** The key result of this stage is a strategy to end or continue the life cycle of an existing building. It overlaps the first stage of a building life cycle that is for a new building. It is the building owner and regulatory definition of the minimum criteria for success for the project when the project involves the renovation, deconstruction or demolition of an existing building. The actual work of removing a building is described in Construction, Renovation and Demolition Stage of the building life cycle.

***What would it take to improve CRD Waste Reduction?*** Where public policy requiring that CRD waste management has been found to be a necessary tool to address an environmental problem, such as in Ontario and Vancouver, these requirements are added to those of the building owner. Additional costs are absorbed by the project; however, these costs are applied to all projects in the area affected by the policy, retaining the relative competitive relationship between companies in that market.

In the case of the Harvey Barracks demolition, even though building owner policy required the implementation of a CRD waste management plan on the project, it was the company that solved the problem of how to realize the value of the materials contained in the project that was successful.

Since 1990, the Federal Government has been evolving policy and legislation that requires all government departments to develop plans to address the environmental issues that they face. Through changes to the Auditor General Act in 1995, each department was required to produce a Sustainable Development Strategy. From this strategy, the Federal Code of Environmental Stewardship and a policy on Greening of Government Operations was developed. Public Works and Government Services Canada [PWGSC] has the responsibility for the development and management of federal buildings and for the application of the policy objectives. Among the Greening of Government Operations objectives for PWGSC are two related to Non-Hazardous Solid Waste Reduction:

- Contribute to the objective of reducing the amount of office [operational] solid waste sent for disposal by at least 50% by the year 2000 relative to 1988 levels; and
- Facilitate the reduction of construction, renovation and demolition waste.

However, even though the ethic is stated in the policy, the language used is still open enough to allow almost any extent of effort, large or small, to meet the policy objective for CRD waste reduction.

The European examples noted in the Planning and Design of the Building Life Cycle for Germany, Denmark and Sweden also represent some of the knowledge being developed about how to avoid future CRD wastes through the modification of current design and material choices.

**Barriers and Opportunities in Different Building Sectors and the Effect of Scale**

The scale and density of human settlement and building activity has a marked effect on the kinds of barriers and opportunities perceived by interview contacts to be present in the Alberta CRD market.

Two scales of settlement are typically found in Alberta:

- Urban.
- Non-Urban.

The urban scale includes the cities and larger towns typically found in Alberta. The Non-Urban scale includes the rural and remote areas of the province. The difference between the two is fairly clear in Alberta. Population density and the intensity of building activity is closely related to the settlement scale in Alberta. Urban areas contain relatively dense concentrations of people and building activity; Non-Urban areas contain very low densities of people and buildings.

In other areas, this relationship does not apply in the same fashion. In North Carolina, for example, some Non-Urban areas have a population density much higher than the Alberta density and an intensity of building activity higher than the level for the Alberta Urban areas. One County School District in the Triangle J region has a school building program larger in scope and value than that for the entire province of Alberta. The barriers and opportunities for CRD waste reduction in these circumstances would be more similar to the Urban ones than the Non-Urban ones in Alberta.

Three broad building sectors characterize Alberta building activity:

- Industry/Commercial/Institutional [large scale buildings or groups of buildings].
- Residential [single family homes or subdivisions].
- Infrastructure [roads, municipal services].

Each construction sector seems to exhibit waste generation characteristics that vary from other sectors, due in part to the different materials required by the Alberta Building Code. The Industrial Commercial Institutional (ICI) projects tend to use non-combustible, in-organic construction materials and can be larger in scale than residential projects. Residential projects tend to use more combustible, organic materials. Both ICI and residential projects produce a much wider range of waste materials than do infrastructure projects. These tend to produce large amounts of a few products such as concrete, asphalt, soils or organic materials such as trees or ground cover. The need to keep infrastructure services in operation during any construction activities also affects the barriers and opportunities for recycling activities.

The following table illustrates some of the key differences that appeared in the interviews within Alberta.

| **Urban**<br>**Industry/Commercial/Institutional** | **Non-Urban**<br>**Industry/Commercial/Institutional** |
|---|---|
| **Barriers**<br>• Market/awareness of each material presents different barrier to recycle, re-use [e.g.: concrete, steel, brick, wood, packaging]<br>• Liability issues [e.g.: control of access to site for owners and general contractors for safety, sale of materials for re-use, re-use of material on site]<br>• Availability of knowledgeable labour to deconstruct materials<br>• Knowledge of markets/opportunities for resale or recycle [e.g.: carpet re-cycle]<br>• Low cost inert landfill sites near urban areas. | **Barriers**<br>• High haulage vs. low disposal cost [varies]<br>• Lack of understanding of material's value |
| **Opportunities**<br>• Establish market certainty to create conditions for development of market capacity | **Opportunities**<br>• More site space available for materials handling/storage<br>• Stand alone economics makes alternate solutions easier to see [not easier to do]<br>• Large scale of project allows for outside expertise to import novel solutions |
| **Urban**<br>**Residential** | **Non-Urban**<br>**Residential** |
| **Barriers**<br>• Fragmentation of decision making due to the evolution of the construction market[many small players with limited knowledge of effects of their choices]<br>• Large education/training effort needed to support changes [due to fragmentation]<br>• Low cost inert landfill sites near urban areas | **Barriers**<br>• Small volume of projects<br>• Strong perception that small projects won't realize cost savings [so we won't try] |
| **Opportunities**<br>• Strong leadership would result in rapid change<br>• Role for sector associations to establish standard expectations and procedures within the market | **Opportunities**<br>• Market for re-used materials [products salvaged in city are sold outside city] |

| **Urban Infrastructure** | **Non-Urban Infrastructure** |
|---|---|
| **Barriers**<br>• Time constraints [short season, can't interrupt use of infrastructure for any length of time ]<br>• Site space restrictions to conduct recycling operations [space restricted by existing facilities and on-going use of infrastructure | **Barriers**<br>• Haulage costs [material volumes]<br>• Location of reprocessing facilities<br>• Onsite disposal of bulky [inert] materials<br>• Low landfill cost of inert materials<br>• Few opportunities to use reprocessed materials |
| **Opportunities**<br>• Industry receptive to use of recycled resource<br>• High haulage vs. low processing cost [varies]<br>• Materials re-useable with limited reprocessing<br>• Market for materials readily available or fairly easy to develop<br>• Public sector nature of owner facilitates standardization of practice necessary for market development | **Opportunities**<br>• Materials re-useable with limited reprocessing<br>• Public sector nature of owner facilitates standardization of practice necessary for market development<br>• Adequate site space for innovative product consolidation and/or storage for future use |

In general, changes in scale of population density and intensity building activity seem to reflect changes in barriers and opportunities. However, the successes achieved in the Australian WasteWise program show that many types of barriers can be reduced when companies are large enough to have a high degree of vertical integration.

In this instance, the Australian and New Zealand governments set up an Environment and Conservation Council [ANZECC] that developed a program to meet national solid waste reduction objectives. The heart of the program was a commitment signed with 5 large construction companies to develop, run and monitor a CRD waste reduction program within their own projects. Each company was free to develop the techniques needed that were consistent with their own business methods.

Each company was required by the commitment to document the methods they developed, monitor the results and report them to ANZECC. In return, ANZECC published the program and its results and promoted the efforts of the participating companies nationally and internationally.

Significant reductions of CRD wastes were noted from the construction operations of the companies. This was in part because the companies were able to re-use waste materials from one large project as a raw materials in another adjacent project of theirs. The companies were large enough to provide the waste management services internally [planning, training, and documentation] and to have sufficiently large project budgets to afford the equipment necessary to re-process waste materials. The size of the companies was such that each did not have to go outside to the public market to find the necessary recycling services or resources.

Even though the large companies could find ways to make the recycling process economical [at least break-even], they still did not see recycling activities as a core money making business activity. Instead, they preferred to sell the waste materials to separate waste recycling contractors to recover the cost of recovery. They preferred not to add site separation and storage activities to their responsibilities. This added to the site overhead cost for the project without the certainty of an equivalent financial return to that from the construction activities.

The results of the Phase I of the WasteWise program were published in a handbook, "WasteWise Construction Program: Handbook, Techniques for Reducing Construction Waste". The Handbook covers:

- Achievements.
- Best Practice Waste Minimization.
- Waste Minimization Strategy
  - Waste Audit.
  - Waste Minimization Plan.
  - Management & Training.
  - Site Arrangements.
  - Contracts and Purchasing.
- Conclusions

The Best Practice Waste Minimization consists of 5 principles or commitments to ensure the company develops and implements policies and guidelines that ensure the CRD waste minimization occurs with the company's projects.

The Waste Minimization Strategy illustrates the issues of each of the 5 steps, with specific examples and solutions developed by the Phase 1 partners of the WasteWise program.

The Conclusion notes the following:

- Waste reduction can be cheaper than disposal.
- Improved arrangements with suppliers can reduce the cost of materials supplied.
- Voluntary waste minimization can "remove the need for costly, separate and disruptive State and Territory-based industry waste minimization controls [legislation]".
- Waste reduction methods can improve a company's commercial prospects.
- Waste reduction methods increases a company's profile as an industry leader by promoting their achievements and the environmental benefits of best practice waste minimization..

Only after large companies with large financial, management and manpower resources assessed the feasibility of this program, did the ANZECC program decide to test the ability of medium to small size firms to achieve the same objectives. This program phase is currently underway and the results will be published in the near future.

The table above illustrates the idea that while the process stages are the same for the different scales and sectors of building activity, there are significant differences in the barriers and opportunities faced by the different sectors in different locations. These differences suggest that factors for the successful implementation of CRD waste reduction would change with the building sector and location within Alberta.

For example, in the ICI Sector in Non-Urban Alberta, haulage costs for any material are significant to collect the material in an economical amount for reprocessing. In Urban, haulage costs would be less and larger amounts of materials would be available for reprocessing. The more significant barrier was stated as being the awareness of the value of the material and the understanding of business and technical methods necessary to create a self sustaining recycling business.

In the ICI Sector in Urban Alberta, the key opportunity was stated as being the opportunity to create the conditions necessary for a self sustaining recycling business. If Alberta Infrastructure, for instance, determined that it was now its policy to require a minimum level of recycling of materials for all its projects, a company could determine a reliable level of business activity from which to develop its business. In the Non-Urban ICI Sector, the lack of an on-going flow of materials for recycling would likely never permit the establishment of a self sustaining recycling activity. However, ample space could be made available, at a regional landfill, for example, to stockpile materials in sufficient quantities for economical re-processing.

## 4.0 Conclusions

***Conclusions***. The following are key conditions for successful change towards CRD waste reduction. Each is intended to support part of system of CRD waste activities that would eventually be self-sustaining and self regulating, with a minimum of government intervention.

- **Value-based Proponent:**

This is a building owner with an environmental ethic that supports the reduction of CRD waste. This building owner is a leader in the field. Projects by dEsign consultants in Ontario commercial projects and GKO Engineering in Alberta industrial projects, consultants selected by building owners to bring expertise and environmental goals to a project and the Federal Government in green office design standards, are examples of building owner leadership.

- **Legislative Support:**

This ensures a level playing field for business competitors. Legislation can start changes happening or more often can support conditions to allow change to be continued and sustained. Ontario provides the closest example of a legislated framework for directing all the players in the building life cycle towards a coordinated objective of CRD waste reduction.

- **Private Sector [Market] Infrastructure:**

This provides the assurance of the continuation of the market for further development. It assures that materials for re-use and recycling are removable from projects and that CRD waste related products and services are available. For example, study of the experience of the City of Edmonton project to establish and support a household waste diversion cycle may provide information about the scale of effort required.

- **Cost Documentation of Current Work:**

Auditing, monitoring and case studies of CRD work in progress is required to provide credible information to initiate behavioural changes and reinforce changed behaviour. Cost savings from CRD waste reductions are more effectively realized as feedback systems mature and information about real results becomes more predictable. Hanscomb's Yardsticks for Costing is the principal Canadian example of cost data provided to the Canadian construction industry for project cost planning by project managers, designers and contractors.

- **Uniform Work Practices:**

This allows CRD waste reduction practices to become more cost effective. It reduces the resistance of contractors to new ways of doing things. It allows work practices to be further developed and to be taught to new employees. This permits the development of a larger pool of experienced labour and movement of staff between firms as workloads rise or fall.

The Australian WasteWise project allowed the very large companies to develop their own in-house methods and training programs. The published results of this program contain many ideas capable of being adopted in Alberta.

Alberta has only a few companies of the large size required to support this effort in-house. A collaborative industry-wide effort to develop standard methods and training programs would benefit all participating companies, particularly the smaller ones, and help to establish a reliable pool of trained and knowledgeable workers. The Rocky Ridge Recycling Pilot Project is an Alberta example of a multi-partner CRD waste reduction project that developed waste reduction methods that benefited the various participants in different ways and produced useful information for future initiatives.

By dEsign Consultants, of Ottawa, have developed a training seminar for participants in the CRD waste cycle. It is intended to explain the basics of the CRD waste cycle, including the economics, evaluation methods, site separation methods and planning for CRD waste reduction activities.

The Triangle J model specification provides a comprehensive set of contract requirements for a variety of different methods of CRD waste reduction activities. This document may require only minor adjustment to suit Alberta requirements. Alternately, the Greater Vancouver Regional District specification and training program may also provide a useful model to follow.

- **Good Information Exchange:**

Private sector contractors need easy access to current information on an as-needed basis. The exchange could be a network, a database, and electronic market, or some other combination.

The automobile industry is currently adopting an Internet-based market to purchase all new components for vehicles. This new electronic market has produced significant changes in the cost of parts. The industry estimates that this kind of information exchange will eventually reduce the cost of vehicle construction by 33%. Similar cost effects could be experienced in the CRD waste market if this approach was adopted. Presently, a web site at www.cdwastex.com is providing "a virtual marketplace linking buyers and sellers of recyclable and reusable construction and demolition [C&D] materials" in Ontario. This strategy would be difficult to implement in Alberta because of large distances and small markets.

Another example is the *wastenot* newsletter, "a quarterly publication on cost effective sustainable construction and demolition", by the Environmental Management Institute and the Royal Architectural Institute of Canada.

Information web sites, such as the Environmental Building News at www.ebuild.com, emerge that provide links to other organizations with similar purposes. The ebuild site has particularly good links to leading edge organizations.

- **Disposal Cost/Tonne and Haulage Costs:**

The cost of material recovery must at least be neutral compared to the cost of removal and disposal. In a densely settled area, the location of the recycler may often be closer [cheaper in haulage] than that of a landfill. In a sparsely settled rural area, the economics may be dramatically different.

***Recommendations*** The following strategies are suggested to overcome the present barriers to a self-sustaining process for CRD waste reduction activity in Alberta. They attempt to utilize opportunities presented by the current Alberta situation to assist the existing CRD waste reduction activity to grow to a self-sustaining economic level that reduces CRD waste to an absolute minimum.

- **Value-based Proponent:**

Find and support the efforts of individuals, companies and organizations within Alberta that are taking initiatives in the area of CRD waste reduction. Climate Change Central could be a model for this approach. Promote these efforts broadly to develop public understanding and support of the economic and environmental importance of CRD waste reduction to Albertans and to make potential building owners aware of the financial and competitive benefits to their businesses.

During review of landfill regulations explore the feasibility of specific product bans, with stakeholders.

- **Private Sector [Market] Infrastructure:**

Encourage Alberta Infrastructure to support the development of the market infrastructure by adopting a policy of mandatory CRD waste reduction on all its own projects. Encourage Alberta Infrastructure to revise its guidelines to clarify the designers' and project managers' tasks, revising specifications to clarify the scope of the contractor's site tasks and paying for the additional costs that may arise while the market becomes better established.

- **Cost Documentation of Current Work:**

Develop easily applied and reliable methods for the auditing, monitoring and reporting of CRD waste reduction work-in-progress. Provide credible information to the market regarding the costs of different deconstruction, re-use and recycling activities to support decision-making by all participants.

- **Uniform Work Practices:**

Establish a collaborative industry-wide training program or separate programs for project managers, designers, contractors and workers to create a broad knowledge and experience base for all players across the province. Collaborate with adult education organizations such as NAIT or SAIT to create effective teaching program content and methods suited to the different needs of the various participants. Utilize existing teaching resources as a basis for the courses and modify them to suit Alberta requirements. Publish guidelines

Collaborate with present model specification organizations such as The National Master Specification Secretariat and Alberta Infrastructure to further develop and publish effective contract specifications modeled on the Triangle J or GVRD CRD waste reduction specifications to guide contractors decisions and behaviour on site.

- **Good Information Exchange:**

Develop an Internet-based information exchange for building owners, designers and contractors to provide easy access to current information on deconstruction, re-use and recycling costs and methods. Link this web site with other similar sites currently in operation.

Study potential for changes to the current CRD waste cost structure and activity if information was available in this fashion.

- **Disposal Cost/Tonne and Haulage Costs:**

Develop a structure of model costs of disposal, at least cost neutral with available recovery methods, to suit the varied conditions across Alberta. Incorporate a mechanism to make adjustments to respond to changing market conditions.

## 5.0 References

The following are reviews of current policy and its impact on the environment used in the discussion in Chapter 4 - Current Types of Public Policies and Guidelines [and Specifications] of this report.


- "Perverse Subsidies: Tax Dollars Undercutting Our Economies and Environments Alike, International Institute for Sustainable Development, Oxford University, UK.
- Environment Council of Alberta, 1998, "Discussion Paper: Economic Instruments for Waste Reduction, Edmonton, 26 p.
- Canadian Council of Ministers for Environment, undated. "Inventory of Economic Instruments Currently in Use in Canada." Winnipeg: CCCME.
- Stavins, RN. 1990. "Innovative Policies for Sustainable Development in 1990's: Economic Incentives for Environmental Protection", Discussion Paper No. QE 90-11. Washington, DC. Resources for the Future.
- Barbier, EB. 1992. "The Nature of Economic Instruments: A Brief Overview." Gatekeeper Series No. 6K 29-02. London, International Institute for Environment and Development [IIED].
- Owens, J. 1993. "Environment and Taxation: Mutually Reinforcing Policies", Bulletin for International Fiscal Documentation.
- Plackett, AC. 1994. "Invisible Persuaders", CA Magazine 127[9].
- Opschoor, JB. 1990. "Economic Instruments for Sustainable Development" The Norwegian Research Council for Science and the Humanities [ed] Sustainable Development and Policy, Oslo: NAVF.
- Cassils, AJ. 1991 "Exploring Incentives: An Introduction to Incentives and Economic Instruments for Sustainable Development." Working Paper No. 13, Ottawa.
- Pearce, D. and Turner, K. 1993. "Market-based Approaches to Solid Waste Management." Resources, Conservation and Recycling.


## 6.0 Database

A database created in Microsoft Excel of sources of information about policies, guidelines and specifications currently in use in Canada, the United States and internationally follows.

## 7.0 Appendix:

***Telephone Questionnaire: CRD Waste Generation, Reuse and Recycling; Current Alberta Policies, Guidelines and Specifications***

1.0 Do you consider the reduction of CRD waste to be a challenge to your company [organization]?

2.0 What, if anything, have you done [or seen done] in your work to reduce CRD waste?

3.0 If nothing, what stops you from doing something? What would get you to do something?

4.0 If yes, give specific details of these activities

5.0 Who was involved?

6.0 What was the activity?

7.0 When did this happen?

8.0 Why was this started?

9.0 What were the results?

10.0 How were the results measured?

11.0 What were the reactions by your company? By the owner? to these activities?

12.0 Were there any unexpected effects, or greater of lesser effects than anticipated, to these activities?

13.0 Do you know of, or have any, policies guidelines or specifications that are useful for conducting CRD waste reduction activities?

14.0 If yes, where would you get a copy of this information?

| Organization/Author | Title | Source | Industry Sector | Life Cycle Location | Scale | Type | Content |
|---|---|---|---|---|---|---|---|
| Robert Steuteville | Big Diversions from CD Debris [] | Biocycle-Journal of Composting and Recycling, Vol 36, No. 9, pp 30-32 | | Construction | | Policy | Private facility operators find a wealth of material in CD waste |
| Industrial Economics | Building Deconstruction and Material Reuse in Washington, DC. | www.smartgrowth.org/library/Dcdeconreport.html | | Construction | Urban | Policy | Overview of the state of deconstruction in Washington, DC. |
| Bette Fishbein | Building the Future: Strategies to Reduce Construction and Demolition Waste in Municipal Projects | www.infominc.org/cdreport.html | Institutional | Design Construction | Urban, Rural | Policy | Identifies successful US strategies to reduce CD waste during design, construction and demolition in municipal building projects |
| Community Environment Council, Josh Fox and Jill Zachary and California Environmental Business Council | Constraints and Opportunities: Expanding Recovery in the Demolition Industry | Community Environment Council [805] 963-0583 | | | | | Analysis of economic, technical and regulatory factors, exploration of strategies to encourage recovery and identify policies and programs for local and state agencies |
| Jay Freeborne | Construction Companies Become Versatile Recyclers | Biocycle-Journal of Composting and Recycling, Vol 35, No. 8, pp 37-38 | | Construction | | Response to effective Policy | Two firms in Puget Sound, Washington, region develop business strategies to handle many different CRD materials |
| METRO Portland, Regional Environmental Management | Construction Site Recycling: Save Money by Recycling | www.metro.dst.or.us/rem/rwp/constrcy.html | | Construction | Urban | Some Policy relationship | |
| Gershman, Brickner and Bratton Inc. | Construction Waste and Demolition Debris Recycling - A Primer | Solid Waste Association of North America [301] 585-2898 | | | | Policy related | An educational document focussing on planning issues and implementation options associated with CD waste recycling |
| United States Environmental Protection Agency, Policy, Planning and Evaluation | Construction Waste Management - A Guide for Municipalities | National Association of Home Builders Research Center [301] 430-6442, Peter Yost. | Institutional | | | Policy background | Basic overview of construction waste recycling |
| National Association of Home Builders Research Center | Construction Waste Management Handbook | www.smartgrowth.org/library/constwastemgnt_hndbk.html | | | | Policy related | Discussion of waste reduction, reuse and recycling of common construction waste materials |
| National Association of Home Builders Research Center | Deconstruction: Building Disassembly and Material Salvage | National Association of Home Builders Research Center [301] 430-4000. | | | | Policy related | Examination of benefits of deconstruction |
| Greater Vancouver Regional District | Demolition and Salvage: A Guide for Developers and Renovators | www.gvrd.bc.ca/waste/bro/dlcgde.html | Institutional | Construction | | Policy related | Step by Step guide to salvage and recycling of building materials on demolition sites |
| Dovetail Consulting Inc. and SALASAN Associates Inc. | Demolition Materials Diversion Symposium | www.gvrd.bc.ca/waste/bro/dlcgde.html | Institutional | Construction | | Policy | Examines deconstruction as a strategy, the economic value of materials and the importance of a provincial demolition waste diversion strategy |
| Pacific Northwest Pollution Prevention Resource Center | | www.pprc.org | | | | | PPRC works collaboratively with business, government and other sectors to promote environmental protection by sharing ideas, identifying opportunities and catalyzing projects. |
| Build America | Journal and radio program features discussions and interviews woth leaders in todays significant building projects in USA. | www.buildamerica.com | various | design and construction | | US issues related | Emphasis on environmental issues and alternative methods of design& construction, features discussions and interviews with the artisans, designers and builders of today's significant building |
| ??? | Get it Built | www.id-m.com/getotbuilt/index.html | residential | design & construction | | building process | An experienced architect/ builder has written a comprehensive, easy to follow book that explains building construction process from beginning to end. |
| Palm Bookstore, Orlando, Florida | source of specialized information materials for construction industry and trades | www.palm-school.com/htm | all, focus on residential | construction | | resource and issues | The bookstore features construction related reference books for all trades. Important to find CRD related materials that are difficult to source. |
| Society of Building Science Educators | Network of educators | http://www.polaris.net/~sbsc/web/sbsehome.htm | | design | all | information network | The Society is an association of University educators in architecture who support excellence in the teaching of environmental science and building technologies. |
| CSI, Construction Specifications Institute | US construction specifications | http://www.csi.net.org | various | specifications | all | policy, specifications | source for purchase of construction specifications in USA |
| ANSI, American National Standards Institute | Construction and Demolition Standards | http:www.ansi.org | various | specifications | | policy, standards | |
| Advanced Building Technologies | US source of materials and technologies | http://advancedbuildings.org | various | design, specifications, construction | | info & contact sources technologies | A database of building related, env. appropriate technologies. Extensive descriptive &contact info. For products in several categories incl: non-toxic materials, waste man., &recycled mat. |
| Building Environmental Science and Technology | Green Building Primer | http://www.nrg-building.com/greenbld.htm | | design | | info. Essays | Available on line in full version at no charge. Other resources and information related facts available in related site. |
| California Integrated Waste Management Board | various | http://www.ciwmb.ca.gov/ | various | design, specifications, construction | | information and resource sources | CIWMB site incl. A section on Construction & Demolition Debris &Recycling. Have compiled a variety of information on recycling construction waste. Two searchable databases available. |
| Florida Design Initiative | e design Online | http://fen.state.fl.us/fdi/index.html | all | all | | policy, State education of industry | The mission is to reorient the building industry to a new standard of practice incl. The design and construction of high-performance buildings with sustainable design. |

| Organization/Author | Title | Source | Industry Sector | Life Cycle Location | Scale | Type | Content |
|---|---|---|---|---|---|---|---|
| Green Design Network | searchable database | http://www.greendesign.net/ | | design & specification | | building resources | A searchable database of 600 green building resources. |
| Green Clips | clips of media and articles on environmentally responsible architecture. | (same as above)/greenclips/index.html | | | | issues | A summary of recent articles in media on env. responsible architecture and related government and business issues. Every two weeks features 4-6 current news items from 60 magazines, newspapers, and specialized newsletters. Free. To subscribe: listserv.energy.wsu.edu/guest/RemoteListSummary/GreenClips. |
| enCompass | virtual tour of 33 projects + info. About recycled prod. | http://www.metrokc.gov/market/encompass/ | | case study | | case study | Two integrated components: a virtual tour of 33 building projects using recycled-content materials; and useful information about these materials in graphically attractive profiles. |
| Environmental Design and Construction | Trade Journal | http://www.edcmag.com | various | design and construction | | trade magazine | Trade magazine with useful articles on all aspects of environmentally responsible design and construction. Free to qualified |
| University of Berkeley California | Environmental Design Library | http://www.lib.berkeley.edu/ENVI/GreenBuild.html | | design | | general source material | General directory of green design resources. Nice background documentation. |
| GreenHOME | nonprofit low income housing /recycled materials sources | http://www.greenhome.org/ | residential | all | | info source | A nonprofit offshoot of Habitat for Humanity. Environment-friendly low income housing information. |
| US National Park Service | Guiding Principles of Sustainable Design | http://www.nps.gov/dsc/dsgncnstr/gpsd | instutional | design | mostly non-urban | policy, federal agency | Written as a guideline for National Park facilities, but a great resource for designers of any buildings or landscapes. Lots of information in a friendly, graphic style. The complete book is available on the Website. |
| Linda Mason Hunter | The Healthy Home | http://energybuilder.com/healthyhomedesigns/ | residential | design | | | A commercial site that offers a glimpse at and information about home plans designed for low environmental impact, low-toxic houses. |
| New York City (municipal gov't) | High Performance Building Guidelines | http://www.ci.nyc.us/html/ddo/pdf/greentoc.pdf | commercial | design | urban | policy, procurement process | Often cited, reference made to good use of cost information. Designed to bring awareness of green design to NYC's building procurement process, but an excellent resource for anyone working to incorporate environmental principles into commercial buildings. Good use of graphics to provide multiple layers of information. Now available free at website. |
| University of Michigan | National Pollution Prevention Center for Higher Education | http://www.umich.edu/~nppcpub/resource/compendig/architecture.html | various | design | | educational resources | A collection of resource materials for use in sustainable design courses, available for free download. Some of the material is a bit sketchy, but worth a look. |
| Natural Resources Defense Council | NRDC's Washington, D.C. Eco-Office | http:/www.nrdcpro/dcofc/dcofcinx.html | commercial/ institutional | all | | case study | A detailed description of one of the most environmentally conscious offices in any urban area. The Natural Resources Defense Council took two floors of a reasonable efficientbuilding and made them into a model of green office design. |
| Rocky Mountain Institute | Institute's Newsletters | http://www.rmi.org | | | | educational and research resources | RMI is a nonprofit research and educational foundation. Its mission is to foster the efficient and sustainable use of resources as a path to global security. Newsletters on website. |
| Austin, Texas | Sustainable Building Sourcebook | http://www.greenbuilder.com/general/BuildingSources.html | | | urban | policy, municipal | The City of Austin was often cited in US interviews as the most complete municipal sustainable building program in the USA. This site offers a number of resources related to green building. Including listing of events, greenbuilding professionals, and the complete Sustainable Building Sourcebook, the primary reference for the City of Austin's Green Builder Program. |
| US Department of Energy | Sustainable Building Technical Manual | http://www.sustainable.doe.gov/articles/ptipub.html | | design | | educational resources | A good overview of green design topics, in 25 chapters written by industry experts. Little in the way of specific, technical information in spite of the title. The entire document can be downloaded as an Adobe Acrobat file from the website. |
| US Department of Energy | Building Technology- State and Community Programs | http://www.eren.doe.gov/buildings/ | | all | | policy, federal programs | Brief introductions to many topics, with links to Department of Energy programs and initiatives on energy efficiency and sustainability in buildings… emphasis is energy. Detailed list of softwre tools. |
| US Green Building Council | LEED (Leadership in Energy and Environmental Design) Building Rating System | http://www.usgbc.org/ http://www.usgbc.org/programs/leed.htm | all | all | all | standard | Formed in 1993, the USGBCc is a coalition of building related organizations promoting green building practices. Included is the LEED building rating system, articles by member groups and building case studies. This rating standard is gaining some acceptance as the premium standard in the USA for green buildings. |
| US federal government | Whole Building Design Guide | http://www.uscost.net/WBDG/ | | | | policy, guidelines | An effort of the US federal government to consolidate design guidelines in one easily updatable reference. Currently inconsistent in depth of content and quality, but contains some good (particularly energy) material. Not mentioned in interviews in US except as a secondary source. |
| | | | | | | | **NON NORTH AMERICAN SOURCES LISTED IN NO PARTICULAR ORDER….** |

| Organization/Author | Title | Source | Industry Sector | Life Cycle Location | Scale | Type | Content |
|---|---|---|---|---|---|---|---|
| UK Association for Environment Conscious Building | Association of Building/ Construction industry members | http://www.aecb.net | all | all | all | information awareness | The AECB was formed in 1989 to encourage greater environmental awareness within the UK construction industry. For visitors the website includes a section on green building news in the UK, a listing of AECB members, and a discussion forum..More extensive resources are available tto members. |
| Delf University of Technology | Interduct | http://www.interduct.tudelft.nl | all | all | urban | research | Interduct is Delft Univ. of Technology's Clean Technology Institute, in the Netherlands. Included is an index to research being carried out in the areas of environment and energy. Focus on building and built environment. |
| Austrailian National Building Specification | WATSPEC | www.ozemail.com.au/NATSPEC/ | all | specifications | all | specification | NATSPEC's primary functions are to improve building industry communications and to develop, produce and maintain the national building specification. Significant supplier of technical material to the Australian building industry. |
| (Australian) Centre for Design | Design Centre | http://daedalus.edu.rmit.edu.au/ | | all | all | research and awareness | The Centre for Design's goals are: To focus the work of Australian designers, researchers, industry and government on the changing relationship between design, production and consumption; To develop community and industry awareness and understanding of the role of design in achieving national economic, environmental and cultureal goals. |