

**USING
TAX SHIFTING AND TAX INCENTIVES
TO PROMOTE THE
DECONSTRUCTION / RENOVATION
INDUSTRY**

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1. Introduction

Demolition waste is a major part of solid waste in North America. According to one source, Canadian landfill content is one-third construction and demolition (C&D) waste.¹ Another source estimates the figure at 25 to 45 percent in North America.² While some of this stream comes from the construction industry (a subject worth a study in itself), "... the majority of the C&D waste stream is a result of demolition and renovation (92 percent) - 125 million tons of waste - and not new construction".³ Another source quotes an EPA report to the effect that C&D waste in the United States amounts to more than half the municipal waste stream, far exceeding previous estimates, and that demolition debris makes up 48 percent of the C&D waste stream.⁴

The leaders in the construction industry today are becoming aware of the value of reusing salvaged materials and recycling what is not salvageable. Even so, there remains concern among public sector regulators as to whether enough is being done to achieve the highest possible level of environmental stewardship.

Deconstruction has been defined as "taking a building or structure apart in a manner that achieves safe removal and disposal of hazardous materials and maximum salvage and recycling of materials".⁵ For the purposes of this paper, **salvaged** materials refers to those that can be reused in essentially the same form while **recyclable** materials are those that require processing before use in the manufacture of a new product.

The objective of this paper is to show how the economic policy tool of **tax shifting** can be used to

1. reduce the inefficient use of resources by discouraging the wasteful elements of demolition; and
2. support deconstruction by increasing the demand for salvaged material.

This paper focuses on the "deconstruction versus demolition" decision, rather than the decision to renovate versus to demolish (or deconstruct) and build new. Given current cost levels, the decision that is most likely to be affected by relatively small cost or policy changes is the decision whether to deconstruct or to demolish. The decision whether to renovate or to build new (after either demolition or deconstruction) would appear to be subject to more fundamental economic factors, including zoning policy, heritage policies, the form of the property tax and the

1 Denhez, M. *Environment On Trial*

2 Construction Materials Recycling Association. *Fact File*

3 Kibert, C.J. et al. *Implementing Deconstruction in Florida*. Section 4.3.1

4 Goldstein, G. *Waste Not, Want Not* . p. 131

5 The Deconstruction /Demolition Planning Committee (made up of members of the provincial, regional and municipal governments, the non-profit sector, environmental consultants and industry) has defined deconstruction in its *Summary Report, Demolition Materials Diversion Symposium, May 1998*, page 4

cost of transportation. This paper focuses on smaller residential projects, which appear at present to be less likely to take advantage of opportunities for deconstruction.

2. Tax Shifting: What and Why?

Tax shifting is defined (in *Environmental Tax Shift: A Discussion Paper for British Columbians*)⁶ as a policy tool by which

“...additional revenue from a new environmental tax would be offset by an equivalent reduction in provincial revenue. This could be accomplished by reducing existing provincial taxes or fees, or by providing new tax incentives to encourage environmentally friendly behaviour.”⁷

It seems logical that the tax system should “...harness market forces so that they work for the environment, not against it”.⁸ However, for most taxes, the opposite is true. Most taxes are now applied to things considered desirable: working for wages (the personal income tax) and expenditures on goods and services (sales and value-added taxes). There are few taxes on polluting activities, and some services with negative impacts are provided at subsidized cost by governments. In fact, it can be argued that our tax system has caused more than its share of the environmental degradation facing Canada today. Very few environmental costs (or “negative external costs”) were included in the costs of production until the latter part of the 20th century. Costs now included in production (“internalized” costs) are largely as a result of regulatory changes. Yet tax changes that send appropriate signals have a valuable role to play:

“Reforming tax laws is an important tool for conservation activists because tax policy is a blunt instrument and its influence on behaviour sweeps broadly. Tax policy does not tell people or corporations how to behave; it merely creates incentives or disincentives, and it’s a tool to complement environmental laws. Tax-based policies shift green reforms from ‘end of pipe’ penalty solutions to economic incentives, a move that businesses should support because it reduces their regulatory burden.”⁹

Environmental Tax Shift: A Discussion Paper for British Columbians describes different “levels” of recycling tax revenue. At one extreme are tax shifts with an immediate return of tax revenue to the payer (such as deposit and refund systems); at the other extreme is indirect recycling through the augmentation of general government revenues. The *Discussion Paper* indicates that the latter category of indirect recycling is not generally included in the definition of tax shifting, which requires that a policy change be revenue neutral for the government. That is, while taxes

6 Taylor, A. et al. *Environmental Tax Shift*

7 Taylor, A. et al. *Environmental Tax Shift*, p 11

8 Dunkiel, B. et al. *Sharing the Wealth*

9 Dunkiel, et al. *Sharing the Wealth*, p 5

on an unwanted activity may increase on the one hand, that increase will be offset by a decrease from a corresponding tax source.

It has been suggested that it might be reasonable to define a tax shift as a set of changes where the balance between new revenues and lost revenues (or expenditures) is reached *over a long period of time*. Groups such as Northwest Environment Watch (B.C.) and the Canadian Centre for Policy Alternatives support the use of environmental tax shifts that could fund programs, rather than restricting tax shifting to programs that collect revenue and then disburse it in an immediate and traceable fashion.¹⁰ If the tax shift is successful, the result is a net decrease in the unwanted activity, and less tax revenue is required to cover the cost to society of that unwanted activity. Tax shifts or “tax incentives” defined in this way can be viewed as a direction for reform of our tax system more generally.

We have chosen in this paper to discuss both conventional tax “shifts” and tax “incentives”.

Several environmental tax shifts satisfying the requirements of revenue neutrality and transparency have been implemented elsewhere. Sweden, Denmark, and Holland have each shifted some of their income and payroll taxes onto carbon emissions, electricity sales, waste incineration and pesticide use. In 1996, the United Kingdom took a slice off payroll taxes and put it on landfilling. In 1995, Spain also cut payroll taxes but raised gas taxes. Currently, Vermont is looking at a report that recommends replacing existing property and goods and services taxes with a pollution tax.

British Columbia recently introduced a tax shift for the owners of beehive burners, a wood waste disposal method. This shift increases the costs of creating emissions while offering a rebate or credit for using new technology or creating an end use for the raw material, such as the generation of electricity.

2.1 Regulations: an alternative to taxes

This paper also briefly examines regulatory changes, such as landfill bans. Regulations can force the environmental costs of various activities to be absorbed by the creator of those costs; that is, costs become “internal” instead of “external”. These costs are in turn passed on to the consumer of the goods affected by the regulation. As costs increase, the consumer is likely to make choices that will reduce the demand for goods damaging to the environment. Others will bear fewer of those environmental costs. In this sense regulatory changes can have some of the impact of a tax shift.

3. Why is Tax Shifting Needed in the Demolition/Building Industry?

If renovation, deconstruction and reuse are indeed economically and environmentally desirable alternatives to demolition and new construction, why are they not the norm in the industry? In

10 Marshall, D. *Shifting Ground*, p 10, correspondence with NEW (BC) project director

other words, why have prices and economic incentives in the private marketplace not led the industry to adopt deconstruction universally?

The answer may lie in the failure of the market to price some goods and services correctly. These distortions result from incorrect pricing of goods and services provided by governments, by a failure of government to apply taxes or fees to damage caused by various activities, or from government intervention and overtaxation in some markets.

Some of the distortions in the market that may lead to distortions in the renovation/deconstruction/demolition decision are:

- ◆ Underpricing of transportation of goods
- ◆ Underpricing of landfilling
- ◆ Overpricing of labour (particularly low-skilled labour)
- ◆ Underpricing of new materials from natural resources
- ◆ Underpricing of energy
- ◆ Lack of compensation to those affected by the noise and upheaval of construction
- ◆ Lack of recognition of heritage or neighbourhood values
- ◆ Property tax disincentives to renovation

The following sections discuss these distortions.

3.1 Underpricing of Transportation of Goods

Economists are increasingly recognizing the fact that motor vehicle road transportation is significantly underpriced under the current tax/expenditure system (by “underpriced” we mean that prices prevailing in the marketplace do not reflect true economic costs). Money is spent to construct, maintain, and monitor the road system. Motor vehicles create a need for public services to handle the problems caused by accidents: a significant portion of state and local police, fire, ambulance, and court system’s resources are related to automobiles. Vehicle travel imposes costs on other vehicles in the form of traffic congestion and increased travel time, imposes environmental impacts on air, land and water.

Only a fraction of these “external” costs of vehicle use are paid through gasoline and vehicle taxes. The remainder of the costs are paid indirectly through property or income taxes, or borne by individuals or society as a whole in the form of additional health costs, nuisance, or poor environmental quality.

The Appendix to this paper contains some further discussion of this issue and references to work that has been done to quantify the impact. In brief, one study

determined that the total annual hidden costs of automobile usage ranged from a subsidy of US\$5.21 to \$10.07 per gallon of gasoline or a subsidy of \$2,185 to \$4,220 per car (in 1991 dollars) to automobile users.¹¹

We have found less data on costs of truck transportation. However, the *1997 Federal Highway Cost Allocation Study*, from the U.S. Dept. of Highways, calculates average roadway costs imposed by different vehicle classes on different types of roads, their user payments, and “the residual external costs”¹². In year 2000 US dollars, the underpricing represented by roadway cost responsibility per mile was as follows:

- ◆ for single unit trucks: 3.4 cents out of total roadway cost of 14.6 cents; and
- ◆ for combination trucks: 4.4 cents out of total roadway cost of 20.2 cents.¹³

To the extent that a major component of hauling charges represents roadway costs, these services will be underpriced.

It is almost certain that the current system of road pricing works against deconstruction (as opposed to demolition) and probably against renovation (by indirectly subsidizing new construction). Renovation makes fewer demands on the supply of new wood and construction materials than does new construction. Deconstruction produces material at decentralized sources within the built up area, which are much more likely to be close to the where they are needed than are the forests and mines that produce new materials.

3.2 Underpricing of Landfills

Until relatively recently, landfilling of material was often significantly underpriced because it was only as new landfills were required that the real economic and environmental costs of landfills have become clear. There is now more awareness of the extent to which landfills may produce leachate containing heavy metals, acids, and other contaminants that can eventually enter aquifers and streams. The resulting pollution may pose a health threat and endanger wildlife and fisheries. Toxic and/or greenhouse gases including methane, CO₂ and volatile organic carbons are also released. In the past, many of these costs had been ignored or absorbed by unfortunate neighbours who were exposed to smells, noise, wind-blown waste and truck traffic, without compensation.¹⁴

11 U.S. Environmental Protection Agency. *Opportunity to Improve Air Quality...* The following estimates were used to make these conversions: 20 mph average fuel consumption; 72.5 x 10⁶ gallons/yr U.S. gasoline consumption; 173 x 10⁴ cars in U.S.

12 Litman, T. *Transportation Costs*, Table 5.

13 American Department of Highways. *1997 Federal Highway Cost Allocation Study* as quoted in the Transportation Demand Management Encyclopaedia (Transportation Costs and Benefits) available from the Victoria Transport Policy Institute website (www.vtpi.org).

14 See for example: Wiseman, C. “Government and recycling. Are we promoting waste?” p. 443.

Under current regulations, in order to develop a new landfill site, present, and future environmental concerns, as they are now understood, have to be addressed. This has driven the capital and operating costs of a landfill to much higher levels.

The Hartland (Capital Region) landfill is a good example. The tipping fee for general waste was \$8.50/tonne in 1985. It became apparent that this represented significant underpricing – many environmental costs had not been factored into this price. By 1993, the fee had been increased in steps to \$75.00/tonne.¹⁵ This dramatic increase was not entirely due to cost increases – the fee includes some of the costs of correcting past underspending on leachate protection, landfill cover, landfill gas management, and other environmental requirements, and a large part of the increased fee revenue was also used to fund a recycling program. Nevertheless, rising environmental standards and improved methods of detecting environmental damage are likely to increase the cost of managing landfills (although some of the costs may be offset by new technologies and methods as experience is gained in the area).

A modern landfill that conforms to the new standards will incorporate the following features (unless favourable local conditions make them unnecessary):

- ◆ location restrictions related to wetlands, floodplains, fault areas, etc.,
- ◆ a liner system of clay and synthetic flexible membrane,
- ◆ controls prohibiting acceptance of special waste unless the landfill is designed for such wastes,
- ◆ a leachate management system,
- ◆ a landfill gas management system,
- ◆ other environmental monitoring and control systems,
- ◆ daily covering,
- ◆ control of rodents, flies, mosquitoes, birds, etc.,
- ◆ controlled public access,
- ◆ site closure procedures,
- ◆ monitoring of groundwater and soil and control of leachate and landfill gas, for several decades after closure.¹⁶

15 Charges per tonne have increased annually as follows between 1985 and 1993: \$8.50, \$9.50, \$10.50, \$13.00, \$16.00, \$22.00, \$45.00, \$70.00, \$75.00 as provided by the Capital Regional District Environmental Services Branch. It should be noted that this fee has not increased since January 1993 and thus , in real terms the price is falling.

16 U.S. Government Printing Office, 1991 cited in Wiseman C. “Government and Recycling. Are We Promoting Waste?”

Government ownership of disposal sites such as the CRD site has undoubtedly led to an earlier acceptance of responsibility for long-term environmental impacts and for impacts on neighbours. However, it has probably led to under-recognition of some costs, notably property taxes and a return on investment in land sufficient to ensure a future site could be purchased and prepared when needed.

3.3 Cost of Labour

A consistent theme of the tax shifting literature is the desirability of shifting taxes away from labour, income and capital and towards pollution, energy and consumption of natural resources. This recognizes that the current system taxes labour heavily, primarily through income taxes, but also through a variety of payroll taxes such as unemployment insurance premiums, Workers Compensation premiums, and Canada Pension Plan contributions. These charges and taxes (they each contain elements of both) probably¹⁷ much exceed the taxes on materials, especially imported materials. Regulations restricting the price of labour (minimum wage laws) and the terms of employment, however desirable for social reasons, also clearly discriminate against labour intensive methods.

The reason possible distortions in labour costs are important in the demolition /deconstruction decision is simply that deconstruction is labour intensive. One study finds that the labour rate, given the total time required to disassemble a building, is the single most important determinant of deconstruction's cost-effectiveness. "While the impact of total salvage value and landfill costs are not insignificant, their impact is much smaller than the impact of labour costs..."¹⁸.

3.4 Underpricing of Natural Resources

Markets have short time horizons and are not good at reflecting possible future reductions in supply. Governments, anxious to encourage economic activity, tend not to collect full rent for use of natural resources. While markets and technology are adaptable and have proved able to adjust to scarcities, it would still be preferable if current prices reflected anticipated future shortages resulting from the diminishment of the earth's limited supplies of some commodities. Fossil fuels are the most significant examples, but old-growth wood, well-located sand and gravel, and some metal ores are other typical examples. Again, higher materials prices would favour deconstruction and renovation over demolition and new construction.

3.5 Underpricing of Energy

Quite apart from the issue of the finite supplies of energy from fossil fuel sources are the emissions of greenhouse gases (GHG's) during combustion of fossil fuels. It is becoming increasingly apparent that energy prices do not take account of the impact of carbon dioxide and other GHG's on climate change and the associated impacts of this change. This situation can be

¹⁷ We expect this is the case because any excess of labour costs over market rates is likely to be absorbed in reduced resource rents or, for internationally traded goods, in reduced production, rather than in price increases.

¹⁸ NAHB Research Centre. *Deconstruction*. pp. 26-7

expected to continue until the Kyoto accord, or some similar agreement that rations and prices carbon dioxide emissions, is accepted.

Underpricing of energy is reflected in underpriced transportation (a further contributor to the underpricing discussed above) and in underpricing of other natural resources (which are likely to be energy intensive in production). Conversely, it should be noted that increasing energy prices may make some existing buildings economically unviable, and may thus to that degree actually increase the attractiveness of new construction or renovation.

3.6 Distortions resulting from the Income Tax System

Apart from the broad issues of taxation as a choice between taxing “goods” and “bads”, there are some provisions of the income tax system that have tended to encourage the demolition, rather than the renovation, of marginal buildings.

Whether *renovation* expenses are treated as maintenance expenses (which can be written off in the year of expenditure) or capital expenses (which can only be claimed over a long period of time) can sometimes be crucial in the renovation versus new construction decision. Mark Denhez, author of *Environment on Trial*, summarized the situation in Canada this way:

“The tax deductions, which a person could claim for demolition, were scaled back in 1981 (though not eliminated); and the rate at which buildings were presumed to lose value was also reduced. However, there was no corresponding clarification of the tax treatment of rehabilitation. As of today, there is still nothing that could be called a unifying vision to provide coherent treatment to the restoration or renovation of buildings: there is even no systematic definition of what rehabilitation expenses on a building are tax-deductible, and which ones must be capitalized.”¹⁹

Also, the author Mark Denhez, author of *Environment on Trial* said this about the introduction of the *Income Tax Act* in 1938:

“[M]ost rental, residential, commercial and industrial buildings were presumed to lose two thirds of their market value within the first decade after they were built or purchased, the rehabilitation of existing buildings was not even recognized (and there was no way of telling whether it was a capital expense or tax-deductible); and the most favourable tax treatment for a building was demolition - more favourable, in fact, than donation of that building to charity.”²⁰

¹⁹ Denhez, M. *Environment On Trial*. Court decisions in the last fifteen years (such as McLaughlin v. MNR, Goldbar Development v. R, SMRQ v. Goyer) have clarified some issues regarding capital expenditures and business expenditures. These decision have allowed property owners to repair or renovate older buildings with updated materials without being considered capital expenditures.

²⁰ Denhez, M. *Environment on Trial*

Since that time, the impact of some of these tax measures have been reduced, but there is still a lack of clarity on the issue of tax deductions for rehabilitation and renovation work.

The income tax treatment of *demolition* costs may also have an effect on the decision to demolish or rebuild. Demolition costs are sometimes treated as part of development cost for income tax purposes. In this case, they can be recovered over the building life (as depreciation allowance). If they must be treated as part of land cost, then they are not recoverable until the land is sold.

3.7 Heritage Buildings are undervalued by the market

The importance of preserving buildings of historic or aesthetic value has been well documented, with benefits listed as including “the cultivation of community solidarity and stability, the advancement of individuals' orientation and identity, and the encouragement of aesthetic excellence as well as its enjoyment”.²¹ In short, heritage preservation gives benefits to the neighbourhood beyond those enjoyed by the property owner.

Clearly decisions about heritage preservation are relevant to the “renovation versus new construction” decision rather than the “demolish versus deconstruct” decision that is the major focus of this paper.

3.8 Local Impacts of Construction

Finally, there are many relatively minor negative externalities connected with construction, including– noise, dust, and dirty sidewalks and roadways. These are not reflected in any government fees or charges. New construction will create more of these externalities than renovation. On the other hand, it might be argued that deconstruction, by stretching out the process of site clearing, creates more of these negative externalities than does demolition.

21 Lewinshon-Zamir, D. *The Conservation Game...*

4. What Determines whether a building will be demolished or deconstructed?

Both published studies and what we have heard from the industry suggests that the decision whether to deconstruct or to demolish is very sensitive to small cost changes.

A detailed examination of the deconstruction industry by the University of Florida Centre for Construction and the Environment²² concluded that a strong role for government intervention in helping to establish deconstruction as a viable alternative to landfill is required.

“Without a legal or an economic push to reduce, reuse and recycle the effort is often ignored. The construction industry, comprised mostly of midsize construction firms, operates under a tight profit margin (usually around 5%). As in most industries, the construction and demolition companies are not willing to jeopardise this profit margin by implementing reuse programs or expanding their demolition practices to deconstruct if the company will not realise an immediate and significant profit. Most businesses feel it is simply not worth the financial risk of often negative monetary payoff to be environmentally friendly.”²³

Another Florida study also found that deconstruction and demolition were close competitors. In one project, for example, “Deconstruction was competitive with demolition over a significant portion of the range of the projected cost of demolition.”²⁴ Deconstruction was estimated between \$9,021 and \$10,802 while demolition was estimated between \$7,000 and \$10,000.²⁵ Another project in Alberta found that the net costs of construction with salvage for resale and recycling was very close to the cost of construction with no sorting of waste on site:

“...Wood, mixed metals, wallboard, and corrugated cardboard were separated on the development site and shipped off site for reuse or recycling at costs which are competitive with traditional landfill disposal... Final cost per house for the non-profit pilot waste collection and recycling service was \$495.00 per house based on 191 home completions. This compares to a typical charge of between \$500.00 and \$600.00 per completed home for normal waste removal service which also includes recycling of wood waste.”²⁶

22 Report entitled *Implementing Deconstruction in Florida: Materials Reuse Issues, Disassembly Techniques, Economics and Policy*

23 Kibert, C.J. et al. *Implementing Deconstruction in Florida*. Section 6.3

24 NAHB Research Centre. *Deconstruction*. p 26

25 NAHB Research Centre. *Deconstruction*. Table 12: "Comparison of Deconstruction and Demolition Costs: Overall Project". The deconstruction cost included labour, equipment, disposal/recycling fees, marketing and recovered income from sale of recyclable/salvageable materials. The demolition fee was simply based on square footage of the project.

26 Alberta Environmental Protection. *Success in Residential Construction...*

This appears to be fairly typical. If so, then the decision whether to demolish or deconstruct is often finely balanced.

The interrelationship among three factors:

- ◆ the value of salvaged materials
- ◆ the cost of salvage, and
- ◆ the cost of landfilling,

determines the decision whether to deconstruct or to demolish a building. We discuss these factors below. We then discuss the holding costs of property, which may be a vitally important influence on the decisions in some instances, and then look at some case studies.

4.1 The Value of Salvaged Material

The value of salvaged material at present is often not greatly in excess of the cost of removing, preparing and selling it. This was the case in the following example from Alberta:

“Earning revenue from the action involved the cost of carefully removing items from the buildings. For example, it cost \$7.53 per square metre to lift hardwood flooring and remove nails... However, this effort resulted in selling the salvaged hardwood for \$10.76 per square metre.”²⁷

Some cost analysis for salvage materials is available from *Old to New - Design Guide - Salvaged Building Materials in New Construction*. The *Guide* compares cost and quality of new and old materials. The table following shows that the cost of salvaged materials is above that of standard grade quality timber (Spruce, Pine or Fir), but competitive with higher quality timber (Hemlock or Fir, Kiln Dried).

Unit Cost Comparison (per linear foot)²⁸

	Salvaged	New	New
	Hemlock or Fir Denailed	Spruce, Pine or Fir	Hemlock or Fir, Kiln Dried
2x4²⁹	\$0.35	\$0.26	\$0.34
2x6	\$0.50	\$0.47	\$0.56

²⁷ Alberta Environmental Protection. *Ninety Percent Diversion...*

²⁸ GVRD. *Old to New - Design Guide*. Case Study #2

²⁹ A “2x4” or “two by four” is a piece of lumber about 1.5 by 3.5 inches thick (the nominal dimensions refer to thickness before planing). Construction lumber is normally used in lengths varying from 8 feet to 16 feet in 2 foot increments.

4.1.1 Producing Salvaged Materials is only the first step

A deconstruction site can be seen as a small “factory” producing salvaged material, in that preparation of salvaged materials (extraction from the building, de-nailing, sorting and stacking) is equivalent to manufacturing them from a valueless building. In this view, it becomes apparent that this “manufacturing” is only the first step of the marketing process. The market has to be made aware that the material is available, informed about its characteristics and quality, quoted a price and told how it can be shipped. In brief, if all the usual steps in the wholesale and retail supply chain must still be followed if one is to meaningfully compare costs of salvaged material with the retail values of new material.

Unfortunately, at small residential building deconstruction project sites materials will be available in quantities more typical of retail purchases rather than wholesale supplies. Even more of a problem is that it is often hard to describe the materials to potential buyers. A builder can purchase, for example, grade-stamped No. 2 green Douglas fir 2x6’s ten feet long, sight unseen, with a high degree of knowledge of what he or she is getting, and can order them in any quantity, delivered exactly when they are needed. The situation is very different with dimensional lumber salvaged from a deconstruction project. The purchaser must typically satisfy herself as to the grade, species and condition of the material, and where it is available, for a limited time, in quantities that may not be sufficient to cover all her needs. It is little wonder that despite their typically high quality the prices paid for salvaged material tend to be low.

The comparison of costs in the table in the previous section, for example, is based on the assumption of equal acquisition costs and does not take into the account the extra time it might take to locate a source of the salvaged lumber. The problem with salvaged materials, according to the report, is finding “a single source in sufficiently large quantities. The time needed to locate and purchase salvaged materials and components is critical to achieving overall cost savings.”³⁰

Thus *Implementing Deconstruction* (a report from Florida) is not optimistic about the ability of the used building materials industry to support itself: “The cost of new materials is simply too low to drive the consumer to venture to other markets for building materials - markets such as salvaged materials.”³¹

One contractor stated that to make salvage worthwhile for the company, revenues must triple the cost of obtaining the materials in order to cover the additional costs of transportation, storage and marketing. Another small deconstruction/demolition contractor said that some materials can only be salvaged if an immediate purchaser is available: the additional costs of transportation to storage make their salvage uneconomic.

30 GVRD. *Old to New - Design Guide*. Section 4.3

31 Kibert, C.J. et al. *Implementing Deconstruction in Florida*. Section 6.5.3

4.1.2 Can Marketing be Improved?

Deconstruction for salvage has a long history, but the conditions under which the industry operates are changing rapidly as environmental concerns become more central. In terms of today's conditions the deconstruction industry can be seen as an immature industry faced with evolving rapidly. This basic problem has been expressed in several ways: "Lack of knowledge in the industry", "lack of architects' and contractors' flexibility", "building code", and "lack of markets".

As architects and contractors become more aware of options for the reuse of salvaged material, it becomes more likely they will incorporate recycled building materials into their designs. However, designers and architects have indicated that it is sometimes difficult and time-consuming to find the right material for the job at hand.

Taking the salvaged automotive parts industry as an example, one can see the possibility of computerised inventory or information exchange service that could assist designers and contractors in their search for materials. This kind of information would make it more likely salvage yards would take the time to salvage material considered as low value or marginal quality.

Some jurisdictions have created incentives aimed at encouraging the development of a growing industry, such as subsidizing financing costs for the purchase of equipment³², and subsidies during the initial set-up period of deconstruction and salvage companies.

4.1.3 Building Code Requirements and the Market for Materials

Building codes are an issue for those who are trying to use salvaged material in new construction, since only grade-stamped structural lumber may be used for most purposes, and salvaged lumber often lacks such stamps.

While building inspectors are given the power to accept an "equivalent" material, what this means is often not clear and they and their employer will bear the liability of any failure. Thus some inspectors are very rigid about the regulations. For example, a City of Victoria inspector recently refused a request to use salvaged old growth Douglas Fir 2x4s for construction of a non-bearing interior partition, a use for which modern finger-jointed 2x3 lumber is acceptable, provided it has a grade stamp. The strength of the salvaged material is probably several times that of the minimally acceptable graded material. Other inspectors may be more flexible and sometimes the variation depends on the experience of the inspector involved.

In our experience structural engineers are often willing to certify old material as acceptable for use, or at least equivalent to modern material of similar dimension. Still, whether material needs to be regraded or whether it requires an engineer's approval for a specific use, obtaining a substitute for a grade stamp will always involve at least some time and expense.

³² TIFAC. *Utilisation of Waste*

Some studies of the practical impact of regrading requirements have been done. One U.S. study of large timbers (6" x 8" to 10" x 18" size) was aimed at determining how damage inflicted on the timbers, such as from nail and bolt holes and splits, affected residual strength. Efforts to have a formal amendment to grading rules were unsuccessful, but the researcher concluded that in any case there is a limited supply of large timbers, and a market for their reuse in timber framing, flooring, and millwork already exists.³³

This is not the case for the usual framing or "two-by" (two inch thick before planing) lumber, available in much larger supply, marketing of this salvaged material is hampered by the lack of a grade stamp.

A group of researchers carried out a careful study of visual grading of lumber salvaged from four buildings deconstructed at the U.S. Army's Fort Ord in California. Several sizes of lumber were collected for grading, from 2x4 wall studs and rafter ties to 2x10 floor joists. The lumber selected at Fort Ord was visually assessed for structural grade by a certified grader³⁴ according to normal standards for West Coast Lumber.

Researchers found much of this lumber was cut from old-growth timber, which usually has a tighter grain structure. Being relatively dry, it is less likely for the lumber to warp on the job site. Results indicate that damage affected the grade of more than a third of the lumber, however. Nail holes accounted for the highest occurrence of grade reduction (36 percent), and edge damage reduced the grade of 26 percent of the lumber.

The study found some pieces of lumber were painted and could not be graded. (Paint can obscure critical defects in lumber, such as slope-of-grain and knots). This decision was made because "typically the shortest piece of commodity lumber purchased for platform-framed construction is a trimmed stud with a length of 92-5/8 inches (2.35 m)". The authors felt there was not a large market for material shorter than 84 inches (2.1 m) and decided not to grade these pieces.

The authors found that, compared with new lumber, salvaged lumber suffered from damage resulting from

- ◆ the original construction process (nail holes, bolt holes, saw cuts, notches;
- ◆ building use (drying defects; decay, as in joists in bathroom areas decayed due to water leakage; and termite damage); and
- ◆ the deconstruction process (edge damage, end damage, end splitting, and gouges).

The study found damage affected the grade of more than a third of the lumber evaluated in the study. The presence of nail holes was the predominant reason, followed by edge damage, likely resulting while removing floorboards from the joists and roof sheathing from roof rafters.

33 Dr. Bob Falk cited in "Deconstruction Fits the Bill..."

34 One of six rules-writing agencies recognized by the American Lumber Standards Committee

The authors found that with careful deconstruction practices, the yield of high grades of lumber could be increased.

The study also graded lumber twice to determine whether yield could be increased by end-trimming each piece to eliminate grade-determining defects. This, of course, results in shorter pieces and loss of material. The study found about one-fifth of lumber could be upgraded by end-trimming, with a loss of length of 2.4 feet for 2x4s and 3.0 feet for other sizes.³⁵ Clearly, cutting and grading deconstruction lumber for maximum value will add to the cost of the material.

It must be remembered that grade-stamping is intended not just for the building inspector, but for the buyer. Material may, on inspection by the buyer, clearly meet his or her requirements, but this is not the same as ordering from a distance without examination and being sure of the quality of material supplied. Grade marking would improve the marketability of deconstruction lumber.

Over time, it is possible building codes will become less restrictive as the characteristics of salvaged material become better known.

4.1.4 Sales Taxes

Provincial and federal sales taxes (PST and GST) are charged on both new and salvaged material. Some salvage yard operators have indicated that it would be a good marketing tool to be able to advertise that the salvage material can be purchased PST-free. An exemption from either tax would be equivalent to a 7 percent increase in the sale value of salvaged material.

A justification for sales tax exemption for salvaged construction material is that the sales tax was paid when the material was originally purchased. Credit for a tax paid is not issued when the materials are deconstructed, and the exemption can be seen as a way of implementing this. In the automobile industry, for example, federal sales taxes on new automobiles are reduced by the tax rate on a trade-in vehicle. In fact, this comparison is not entirely valid because the increase in the value of building material created by the process of extracting it and preparing it for sale is properly the subject of value added tax, just as the difference between the retail and the trade-in value of an automobile is properly taxed. Most salvaged material would be of very low value before extraction from the building.

4.2 Labour Costs

In discussions industry representatives made strong arguments that labour costs are the key factor in the “demolish versus deconstruct” decision. The value of much salvaged material is so low that the quantity of material salvaged is extremely sensitive to wage rates.

35 Falk, R. “Effect of Damage on the Grade Yield of Recycled Lumber”

Costs for labour (including payroll taxes) will generally be higher in a deconstruction project than in a pure demolition project.³⁶ These labour costs must be offset by savings made on the return from salvaged material, lower landfill or recycling costs, and possible reductions in transportation costs.

Some stakeholders indicated that a more detailed analysis of labour costs would show that in some cases, notably public sector projects where labour wage rates are set, the allocation of labour is not economic (an example is a carpenter's wage for denailing and stacking salvaged lumber). Some of the sample projects examined in this paper operated under similar constraints and thus the usefulness of their conclusions on overall project economics is suspect.

Our own research in the industry confirms the view that much of the work of salvaging material can only be done economically if wage rates are low. Indeed, much material is sold "as is, where is" with the expectation that the purchaser will remove it.

We have been told that wage rates in the \$10 per hour range are often paid in the sector of the industry with small-scale firms, and we suspect that payment is often made in cash without formal records being kept. Clearly, labour paid at these rates will tend to be entry level workers or those with a less firm attachment to the labour force, so that (although this employment might be considered particularly desirable from a societal viewpoint) productivity will likely be less than that experienced in many of the examples we have provided in this paper, which tend to come from larger firms or government-sponsored programs. Thus, wage rates that appear to be low will not be reflected directly in lower costs. Nevertheless, it is clear that the outcome of the demolition/deconstruction decision will be very sensitive to wage rate changes.

4.2.1 Regulatory Requirements

Workers' Compensation premiums are one of the overhead costs that add to labour costs of a deconstruction project. In addition, Worker's Compensation requirements on job procedures may add to costs of operating a deconstruction site. For example, one small deconstruction operator who spoke to us had been told that in addition to an Industrial First Aid certificate he also was required to file a plan for deconstruction of the building he was working on. This plan would have cost him \$250, a significant addition to his costs. He was told that the inspector expected he would not be able to meet the requirements and would have to leave the industry, which in fact he has done. While deconstruction job sites are similar to construction job sites, and there are good reasons why they are subject to the same WCB requirements for worker protection, scaffolding, etc, clearly these requirements will have a much bigger impact on a deconstruction project costing hundreds of dollars than on a construction project costing tens of thousands.

³⁶ Payroll taxes include the employer's portion of Canada Pension Plan Contributions, Employment Insurance premiums, and Workers Compensation costs.

Hazardous materials are an increasingly important issue in worker safety and consequently in labour costs. The requirement to deal with environmentally harmful materials can change the economics of any demolition or deconstruction project entirely. As environmental standards increase, the issues of asbestos and of lead paint, found in most old houses, and preserved wood, found in most newer ones, will have to be dealt with.

Because the handling of hazardous materials is regulated, contractors acting lawfully would, in principle, incur the same costs to deal with the hazardous materials whether the building is to be deconstructed or demolished. Indeed, some degree of deconstruction might be required to remove hazardous materials in any case, thus making deconstruction more attractive. In practice, while regulations governing hazardous waste are difficult to enforce in any case (for example, we understand that at some periods in the past asbestos was used to strengthen plaster and even as a paint filler as well as an insulator and floor underlay), regulations are probably less likely to be enforced for a demolition taking half a day than for a deconstruction lasting two weeks where workers may be exposed over that period of time and where there is some danger contaminated materials will be reused. Thus it is not immediately clear how these will affect the choice of method.

4.3 The Importance of Avoiding Disposal Cost

Diversion of material from landfills translates into savings in disposal fees. Diversion costs money, but usually yields some revenue. One contractor commented that in the deconstruction business the savings is in the avoided disposal cost (transportation and tipping fees), with salvage revenues covering the cost of the additional labour required to disassemble and sort.

A detailed case study undertaken in Maryland³⁷ confirms the observation made in several studies, and a conclusion from our own conversations with deconstruction practitioners, that if deconstruction is to be economic, the added labour cost of deconstruction must be offset not only by sales of salvaged material but by reduced disposal cost.

Any sale of salvaged material naturally reduces disposal costs. This applies to material given away; one traditional way to reduce avoid disposal costs, used in the Victoria region in many residential projects, has been simply placing a sign outside the building inviting those interested to come and help themselves. However, in some instances this practice has been made illegal under municipal bylaws. WCB and other liability issues will make this less likely in the future.

Some material, if not salvageable, can be recycled for re-use (we return to this below). And where material can be neither salvaged nor recycled, sorting it may reduce tipping fees. As the disposal/recycling industry evolves, a range of tipping fees are being applied to ever-more carefully defined materials, with, in general, more carefully sorted materials resulting in lower fees.

37 NAHB Research Centre. *Deconstruction*

4.3.1 Tipping Fees

Tipping fees vary greatly around the province,³⁸ and there are differing views of the impact of tipping fees on the decision to demolish/deconstruct/renovate.

One Florida study found this result:

“[T]here is a correlation between disposal costs (tipping fees) and the construction industry finding alternative outlets for their waste. The turning point for tipping fees lies around the fifty-dollar mark. In regions where tipping fees have approached the [US]\$50 per ton mark the contractors, workers, developers and owners are not only more open to waste disposal alternatives, but businesses exist to offer alternatives.”³⁹

Another report, written for the European Commission, found a slightly different result: “Although there appears to be a link between the levels of landfill costs and the extent of C&DW [construction and demolition waste] recycling...the statistical correlation does not appear to be very strong.”⁴⁰ According to the European report, “the holder of the C&DW must face a significant financial cost for landfilling waste, with hazardous or mixed waste facing significantly higher costs (to avoid contamination and to discourage mixing).”⁴¹

One contractor we contacted observed that an increase in tipping fees will impact construction and demolition waste only to the extent that tipping fees account for the total cost of disposal. Where collection and hauling account for a larger portion of waste management, changes in tipping fees will be less effective.

As fees for public-operated sites increase two different outcomes have appeared. One is an increase in recycling activity, as hauling to a landfill becomes more expensive than the alternatives. The other is the opening of private landfill sites that may not be operated to the same standards as the public-operated sites. In order to compete for business, the fee for the private site needs to be only slightly lower than that of the public site, but may have to be substantially below the competition if the site is far enough away from urban areas that the increased transportation cost acts as a barrier for most users.

It is essential, of course, that the tipping fee structure works in favour of sorting demolition C&D waste. We have been told that in the CRD it has been possible for unsorted drywall to be “dumped” in small pieces as part of unsorted C&D waste, at a lower rate per tonne rate than if it were separated. Obviously this pricing discourages deconstruction. An example of a successful private sector response to higher tipping fees is the recycling of concrete. Tipping fees for clean concrete are very low, as little as about \$1 per ton in some areas of the Province (the presence of

38 Based on our informal survey of regional districts.

39 Kibert, C.J. et al. *Implementing Deconstruction in Florida*. Section 4.5.3

40 Symonds Group et al. *Report to the European Commission*. Section 9.67

41 Symonds Group et al. *Report to the European Commission*. Section 8.7.ii.

rebar in concrete increases tipping fees to something in the order of \$5 per ton). Concrete was banned from the CRD landfill in 1995, but in Victoria the private facility tipping fee is under \$5 per ton, compared to the CRD rate of \$75, so the ban is now of little importance. Economically successful concrete recycling operations have been created over the last few years.

4.3.2 Transportation/Hauling Costs

For some of the developers we talked to, this was a significant factor affecting the decision to salvage, recycle, or landfill. As we suggested above, distortions in road use pricing, in fossil fuel pricing, and in carbon dioxide emission pricing all contribute to an underpricing of transportation. If these costs were correctly reflected, the emphasis on reducing material requiring disposal would increase.

4.3.3 High Waste Diversion Can Be Achieved if Costs Are Not Considered

“Although the optimal solution for the environment is to salvage all materials, this is not the optimal economic solution for most starting deconstructors...”⁴²

It is useful to ask how much demolition waste can reasonably be diverted from disposal. Several pilot projects have provided some indication of practical waste diversion.

In the area of *construction* waste, for example

“[i]n Northwest Calgary, a land developer, new home builders, a waste management company and the Calgary Region Home Builders Association are establishing a high standard of waste minimisation for their industry. In a co-operative pilot project they successfully diverted from landfill 458,312 kg, or 73 percent, of the waste generated during the construction of 191 new homes. Wood, mixed metals, wallboard, and corrugated cardboard were separated on the development site and shipped off site for reuse or recycling at costs which are competitive with traditional landfill disposal...”⁴³

In the area of *demolition* waste, in one pilot project “[i]t is estimated that the volume of material diverted from landfill was ... greater than 90 percent compared to traditional demolition and landfill disposal...”⁴⁴.

It is important to note that in many pilot projects the amount of waste diversion is well in excess of what could be achieved in the market, because some salvage and sorting is very often done in excess of the economic return on the salvage material. Even given the many costs of demolition and waste disposal that have not been correctly reflected in prices, the situation of having *no*

42 Kibert, C.J. et al. *Implementing Deconstruction in Florida*. Section 6.3

43 Alberta Environmental Protection. *Success in Residential Construction...*

44 Alberta Environmental Protection. *Ninety Percent Diversion...*

demolition waste in the landfill would not be achieved using tax shifting to correct these distortions. While obviously regulations could be written to eliminate demolition waste entirely, these would quite reasonably be perceived as unfair to the industry. Government policies that achieve further reductions in other waste, such as household garbage, disposed to landfill could be implemented at lower economic cost before full diversion from demolition is contemplated.

4.3.4 Recycling Is Becoming Increasingly Important

Not all material in a building can be salvaged. Even now, most materials in a building, especially residential buildings, are not suitable for salvage, but may be recyclable. Recycling will become more important over time, given modern building practices such as use of glue and nail guns, which make the structure harder to take apart, and modern materials, which include a high proportion of laminated or composite elements.

The “highest” form of recycling is creating new construction materials from old. There is a small amount of experience in this area. For example, in 1999 a new company in Charlotte, N.C. was founded to take in scrap lumber from construction sites and make new wall studs. Defects and knots are cut out and the wood is then finger jointed. “The benefits of the reconditioned wood are that the pieces are stronger and straighter than traditional lumber at about the same cost.” So far this has been applied only to construction site material, which can be expected to be more free from nails, paint and other defects than demolition site material. This is still a small-scale operation, and it depends, as do many other salvage operations, on high tipping fees to make it economically viable.⁴⁵

A second example is New West Gypsum in the Lower Mainland, which processes scrap gypsum wallboard into gypsum and paper, both of which are sold to a local wallboard manufacturer and use in the manufacture new wallboard. As in the previous example, construction generates the cleanest feedstock, but NewWest Gypsum has developed technology to produce clean gypsum and paper from deconstruction projects.

A second potential use of wood waste is as a raw material in the growing wood panel industry where new plants are being built to produce particle board, OSB (oriented strand board) and MDF (medium density fibreboard). These plants consume tremendous amounts of wood fibre.⁴⁶

It may be that demolition waste could potentially be used as feedstock for such facilities, but other used materials, such as construction waste and pallet material, are likely to be more attractive initially because of their comparatively higher quality. For example, the pallet industry in the United States consumes between 16 and 18 percent of the nation's lumber based on estimates of the U.S. Forest Service. There are between 4,000 to 5,000 companies involved in this \$6 billion industry, producing over 600 million pallets annually, obviously a potentially significant source of feedstock.⁴⁷

45 Gray, K. “The Many Routes to Recycling Wood”

46 “Recovery Options for Wood and C&D”

47 According to the trade publication *Pallet Enterprise* cited in “Recovery Options for Wood and C&D”

There are some serious problems connected with using demolition waste for raw material. Even a U.S. recycler who manufactures “hog type [fuel] chips that are not suitable for fibreboard products”⁴⁸ prefers to use material from new construction to avoid concerns about asbestos or lead painted wood. Any contamination, even construction crew lunches, is a problem. Another use for chips is as bark mulch or compost; again, however, wood pulled from demolition debris presents a challenge.

A problem for some forms of recycling is avoiding pressure-treated wood. One purchaser of chips who used them as a bulking agent in composting of biosolids detected elevated levels of arsenic in some batches of compost, and believed the source was the chips. The best use for pressure treated wood, along with painted wood and fibre board, according to one study, was to grind it and use it as cover material in a landfill. Obviously this use would depend on local standards.⁴⁹

4.4 Quantifying the Costs: What is in a House?

In order to estimate the influence of various cost factors on the demolition/ deconstruction decision, we looked at the composition of several sample houses built at different times. The amount of major building materials, including small and large dimension structural lumber, panelling (plywood etc), roofing shingles, plaster or drywall, and concrete were estimated. The details of the materials contained in several of these houses have been described by their designers.⁵⁰

A brief description of the houses:

- ◆ **1911 large house:** a two story plus low basement house built from a standard builders’ plan book for a middle class family about 1911. It contains about 1,800 square feet of finished space, plus 1,100 feet of low (5’6” to 7’) basement, plus 200 square feet of porches. *Source: Geoff Young*
- ◆ **1968 small house:** A low cost 500 square foot house with 180 square foot porch and 500 square foot basement, designed ca. 1968. *Source: Donald R. Brann, How to Build a Low Cost House Above or Below Ground*
- ◆ **1984 low-cost house:** An economical one-story three bedroom, two bath, 1,200 square feet, built on a slab, designed ca. 1984. *Source: James Warren, Building a Fortune*
- ◆ **1990 large house:** A two-story house 2,400 square feet heated, plus 760 square foot garage and 850 square feet of porches and decks, designed circa 1990. *Source: Perry Ennis, Understanding Home Construction*

48 “Recovery Options for Wood and C&D”

49 “Recovery Options for Wood and C&D”

50 Brann, *How to Build...*, p 30. Ennis, *Understanding*, p 20. Warren, *Building a Fortune...*, p 14.

- ◆ **1995 average house:** two-story house, 1,500 square feet, 2 bathrooms built with modern technology (1990's). *Source: CMHC Optimise Study on Embodied Energy*

Table 1 (on the following page) shows the approximate quantities of the major groups of materials listed below (lumber, plywood, drywall, concrete, etc.) in total weight and weight per square foot of building area for the houses we have discussed. Some figures are derived from lists of materials to be ordered; in these cases the figures allow for 10 percent wastage during construction.

Framing lumber (2x4 and 2x6)

This kind of material has some potential for salvage (there is apparently a market for old, high quality fir 2x4s to be resawn into floorboards) but in general it is difficult for this small-dimension material, which normally requires regrading, to compete with new material.

Structural lumber (2x8 and greater)

This material has good potential for salvage because of its higher value and lower labour costs. Regrading is more likely to be worthwhile, or alternatively the material may be used in manufacturing higher grade construction materials (trim, etc) or even furniture.

“1 by” lumber

This material (1x8, 1x10, shiplap etc, which is actually $\frac{3}{4}$ inch thick as used) was formerly used for exterior wall and roof sheathing and for subfloors. It was very largely displaced several decades ago by plywood, and later, OSB. Some 1x8 material is still used for construction forms and then incorporated into the house sheathing. Salvaged material can be used for forms.

Panels

The plywood, oriented strand board (OSB) and particle board that have largely replaced “1 by” material are unfortunately much more difficult to extract for reuse without damage. Panels are often glued or attached with nailguns (seismic requirements have increased the number of nails used in many applications).

4.5.1 Table 1: Composition of a House

	Large House	Small House	Low-cost house	Large House	Average House
Year Designed	1911	1968	1984	1990	1995
Sq. Ft. Total	3,100	1,180	1,200	3,220	1,517
Sq. Ft. finished	2,900	1,000	1,200	2,370	1,517
Building Material	Weight in metric tonnes, less waste during construction				
2x6 and smaller	3.1	2.7	2.5	8.4	3.0
2x8 and larger	3.4	0.8	1.1	8.1	1.6
"1 by"	6.7	1.2	0.2	0.0	0.0
Plywood	0.0	2.8	5.1	3.8	3.1
Drywall/plaster	4.7	0.7	3.7	Not provided	3.6
Shingles	2.2	0.7	1.8	Not provided	1.5
Concrete	15.5	9.6	19.9	Not provided	111.8 ⁵¹
Total	35.6	18.5	34.3	20.3	124.6
	Weight in metric tonnes, per thousand square feet				
2x6 and smaller	1.0	2.3	2.1	2.6	2.0
2x8 and larger	1.1	0.7	0.9	2.5	1.0
"1 by"	2.2	1.1	0.1	0.0	0.0
Plywood	0.0	2.3	4.2	1.2	2.1
Drywall/plaster	1.5	0.6	3.1	Not Provided	2.4
Shingles	0.7	0.6	1.5	Not Provided	1.0
Concrete	5.0	8.2	16.6	Not provided	73.7
Total	11.5	15.8	28.5	6.3	82.2

⁵¹ This figure appears high compared with the other examples; the architect who supplied this information indicates that the amount of concrete in a house may vary considerably, but that it has increased over time as foundations and floor slabs have increased in size.

Drywall

Drywall (“gyproc”, “sheetrock” or “gypsum wallboard”), which has effectively replaced plaster, is a major weight component. Drywall cannot be reused but clean drywall can be recycled as noted earlier, or used as a soil conditioner.⁵² It can become a problem when landfilled, especially in moist climates, because its decomposition by bacteria results in emission of toxic hydrogen sulfide gas and leachate containing toxic metallic hydrogen sulfides,.

Shingles and roofing

These vary in their recycling potential. Asphalt shingles, except for those containing asbestos⁵³, can be shredded and used for road base or driveway blacktop. At present, flat roofs that contain tar, pea gravel and fibreglass insulation, and roofs where cedar shingles cannot be separated from the asphalt shingles placed on top of them, are landfilled for lack of markets.⁵⁴

Concrete

Concrete can be readily recycled as an aggregate substitute, either directly as road fill or in the manufacture of concrete. The weight of concrete in a house will vary enormously with ground conditions, but in general the amount used in a typical dwelling has been increasing over time.

Other material

There are no good weight estimates for speciality materials such as doors, fireplaces and mantels, baseboards and trim, and hardwood floors, since these will vary enormously with the location, style or quality of house. Windows can be significant in terms of weight, but efforts to recycle them have been hindered by changing energy efficiency standards.

Metals can be recycled readily. The weight of electrical wire and certainly the weight of reinforcing steel (now used in some single family dwellings) have been increasing. On the other hand, cast iron drainage pipe and copper water supply lines have largely been replaced by plastic products and are now found mostly in older buildings.

While the table shows the quantities of materials in the houses we have discussed, even under the best conditions only a fraction of most of these materials could be salvaged for reuse (although recycling may achieve greater utilisation). In practice, in many cases virtually no material is salvaged or recycled, except for concrete, discussed below. In addition to those already mentioned, some other factors will affect the deconstruction/demolition decision:

Much depends on the ***age of the house***. Most older houses are built with lath and plaster instead of drywall (“gypsum board”). We have been told that other things being equal, buildings with lath and plaster, rather than gypsum board, walls are less likely to be deconstructed for two reasons:

52 “Processing C&D Debris for Markets”

53 Materials containing asbestos are considered special waste if the asbestos is friable, and the shredding of such shingles may release asbestos fibres.

54 “Processing C&D Debris for Markets”

1. It requires more labour to remove lath and plaster from walls, to expose and to denail framing lumber.
2. Lath and plaster walls can be crushed together with wood and other material for landfilling; that is, unlike drywall they do not require removal before machine demolition.

Factor 1 makes salvage less attractive while factor 2 makes demolition more attractive: both work against deconstruction.

On the other hand, an examination of the information presented in the section above on “What is in a House?” suggests that older houses are likely to use “1 by” material or shiplap (that is, boards that are $\frac{3}{4}$ inch thick and 5 to 11 inches wide) rather than plywood or OSB for sheathing walls, subfloors and roofs. This material, as noted, is generally more easily salvaged for reuse (partly because in older buildings fewer nails tended to be used) than are the more modern materials. Wood flooring, if it remains in good condition, is worth disassembling for resale, and is more likely to be found in older houses.

A major difference between old and new houses is the amount of *concrete* embodied in their construction, with new building codes requiring much more concrete. This would be a major factor in disposal costs, except that, as we have noted, economically successful concrete recycling operations have been created over the last few years. Indeed, concrete was banned from the CRD landfill in 1995.

As the example we present below shows, tipping fees for concrete at recycling facilities are so low relative to tipping fees at landfills that concrete is recycled whether the building is deconstructed or demolished. Concrete is thus an example of a successful diversion industry that now needs no government support. As other markets grow for the materials that are diverted from landfill, especially as new technologies for sorting, processing and recycling are developed, it can be hoped other materials will follow this progression.

As noted above, another major factor varying with the age of the house is that modern joinery methods using glue and/or nailing guns make separation of joined materials without impacting salvage value more difficult.

4.5 Holding Costs of Land and Buildings (including time and financing costs)

The costs of holding land for future development depend on many different factors and will vary by individual project. Financing costs (interest paid on loans that are used in the development/construction process) are likely to be a major cost and if the time to hold the land before development begins is extended then those additional costs may have an effect on development decisions.

A simple economic analysis would assume that holding costs are incurred only in proportion to the value of the land being held, i.e. that the land purchase represents the total investment made in the project. Indeed, in some cases other activities connected with the project – design, local government approvals, sales, etc, may be taking place at the same time as site clearing, so that there is *no* additional cost to extra time spent clearing the site with careful deconstruction.

In some cases, however, other costs, such as architects' and engineers' fees, may have been incurred, and this investment must be added to the investment in the land. If the project developer and his team cannot turn their time to other projects while the site is being cleared, the cost of their time must be added to the opportunity cost of time spent in deconstruction. A borrowing facility may have been arranged and may incur costs even before draws for construction begin. All these factors, which will vary with specific individual projects and developers, would increase the cost of holding land during deconstruction or demolition. It is clearly possible that in some cases holding costs may be one of the most important factors in tipping the balance between deconstruction and demolition.

Property taxes are likely to vary less than property values (since tax rates are likely to be lower in high value areas) and they might range in the order of \$5 to \$15 per day. Property taxes, of course, will depend on whether the property in question includes a usable building. October 31 is the key date for establishing property taxes in B.C., and in the case of a building planned for removal around that date there may be an incentive to proceed quickly.

We return to the information presented in the table above in our discussion of the factors affecting the deconstruction/demolition decision.

4.5.2 Some Lessons From Experience: Net Costs Of Deconstruction And Salvage

A few careful studies of deconstruction have also been undertaken for individual projects. Two examples follow:

Riverdale Village [Baltimore, Maryland]

This case study involved the deconstruction of a 2,000 square foot, four-unit wood-frame, two story urban residential building to clear a site for housing. The project was selected for the case study because the owner was interested in alternative approaches to demolition and there was ample time for deconstruction research.

In this case, as in most, the attributes of the building were important. "Every component, its condition, and the manner in which it is secured to the structure can have an impact on the cost-effectiveness of salvage..."⁵⁵

55 NAHB Research Centre. *Deconstruction*. p 5

The experience of this study concluded that the fact that the buildings were built before 1950 made them more recyclable. The authors noted that later technology used engineered wood products and composite materials which are difficult to disassemble or have low salvage value (information collected for this report confirms this). Wood framing, particularly large dimension materials, was "...easily taken apart with bars and hammers and with high recovery rate of materials."⁵⁶

Labour hours used to extract materials are provided in this case study.⁵⁷ Some examples include the following:

- ◆ Oak strip flooring: 0.038 hours per square foot
- ◆ Windows: 0.54 hours each
- ◆ Stairs: 0.3 hours per riser
- ◆ Chimney: 0.16 hours per cu.ft.⁵⁸

The building was deconstructed with a total of 291 hours of disassembly, 433 hours of processing and 135 hours of production support, a total of 829 hours, or about 0.41 hours per square foot. This does not include non-productive time spent on research and discussion.

In this case, high wage rates were being paid because of a federal government wage requirement for this research project that pushed wages to well above market levels. The deconstruction of this building cost \$13,843. The value of the salvaged materials was estimated to be between \$2,791 - \$4,572, but the income from the sale was only \$2,440 as some of the unsold material was donated.⁵⁹ The net cost after the sale value of material salvaged was \$11,153. In this case, traditional demolition would have cost between \$7,000 and \$10,000 (based on an estimate of \$3.50 – \$5.00 per square foot).

Material diverted totalled 70 percent by volume and 76 percent by weight.⁶⁰

The Presidio [San Francisco, California]

This case study involved the deconstruction of a single story, wood-frame warehouse building. The 9,200 square foot (60x153 ft) building was deconstructed in four weeks by a five-man crew. Time required was approximately 700 hours of deconstruction, plus 300 more hours for sorting and stacking wood as well as cleaning the site by less-skilled labour, or about 0.11 hours per

56 NAHB Research Centre. *Deconstruction*. p 18

57 Demolition Materials Diversion Steering Committee. *Executive Summary*

58 NAHB Research Centre. *Deconstruction*. Table 4: "Labor summary of tasks performed in labor-hours"

59 NAHB Research Centre. *Deconstruction*. Table: 10 "Quantities of Salvaged Materials & Estimated Value & Table 11: "Results of Riverdale Site Sale"

60 NAHB Research Centre. *Deconstruction*. Table 9: "Diversion Rate"

square foot (total labour hours). This deconstruction project produced 65,000 board feet⁶¹ of high-quality lumber (87 percent recovery).⁶²

This project was much less labour-intensive than the smaller Maryland project described above in terms of time invested per square foot of building. The building, unlike a residential building, was characterised by large high quality dimension lumber (mostly in the flooring) and no interior paint. Like the Maryland project, however, there was very little machinery used to deconstruct, thus creating less damage to salvaged materials. These factors contributed to the high recovery rate and high value of material recovered.

This building was only one of a large group set to be demolished. The savings in demolition cost when this building was deconstructed was a reduction in the demolition subcontractor’s bid of \$16,800. There was no itemisation of demolition costs by separate building. The cost of deconstruction for this project was approximately \$25,000 (\$55,000 in expenses minus \$30,000 in onsite sales).⁶³

A 1930s house [Victoria, British Columbia]⁶⁴

To get an idea of costs facing a deconstructor in the Victoria/Vancouver region a demolition/salvage company was asked to provide a cost quote on a sample house: a bungalow on a sloping site with a partial ground level basement. This house has 1,400 square feet on the main floor with about 800 square feet developed in the basement. It was built in the 1930s. The gross costs for deconstruction and demolition are compared in the following table:

	Deconstruction	Demolition
Labour	\$6,400	
Machine and operator	1,000	\$1,000
Drywall removal	300	300
Concrete disposal	960	960
Waste disposal	840	3,360
Wood disposal	400	
Total	\$9,900	\$5,620

Before demolition or deconstruction, drywall would need to be removed by hand, requiring a half-day and \$300 for labour and disposal in the case of either deconstruction or demolition. Not including drywall removal, deconstruction was estimated to require about 320 man hours, or 0.15 hours per square foot. With estimated labour costs of \$20 per hour, the total cost was \$6,400 or \$2.90 per square foot. Thus total cost was \$9,900 and the time required was 12.5 days.

61 A board foot is a volumetric measurement equal to 1x1x12”.

62 Kreitner, P. *Building Deconstruction for Reuse and Recycling*, p 5.

63 Kreitner, P. *Building Deconstruction for Reuse and Recycling*, p 7.

64 Fulton, C. *Cost Analysis – SFD – 1930’s*. The house is located in Victoria but costs were based on Vancouver prices.

Demolition required no hand labour (after drywall removal) and much less elapsed time (1.5days). Demolition did involve additional costs for hauling and disposal of other demolition waste, at a cost of \$2,560 more than deconstruction. Total cost was \$5,620.

In this case, disposal costs for concrete are the same for demolition and deconstruction.

The material recovered from the deconstruction process had a value as follows:

Structural lumber	\$1,056
Shiplap (“1 by” material)	100
Doors, trim, cabinets, fixtures	900
Windows (double glazed)	600
Metal scrap	100
Total Value	\$2,756

The value of material in this case is only one-third of the cost of labour required to extract it. There is an additional savings represented by elimination of 2 loads of demolition waste costing \$840 each to haul and dispose of, and a further saving because one load of demolition waste is replaced by one load of clean sorted wood, costing only \$400 to dispose of. This represents a savings of \$2,120.

Even with this savings added to the sale value of the recovered material, only three-quarters (\$4,876) of the labour cost of \$6,400 is recovered, so that the net cost is \$6,844, well above the cost of demolition. According to the operator, this house is typical of those being demolished in the GVRD.⁶⁵

4.6 Ranking of Costs in a Sample Project

In discussions with stakeholders⁶⁶, a wide variety of responses were given to the question of which factors are most important in the decision to deconstruct or renovate instead of demolish.

The relative importance of different costs will vary by project. The case study of the “1930s house” above has been used as a context for ranking the individual factors in the decision whether to demolish or to deconstruct. In order to rank the factors listed below, we have looked

65 April 18, 2001 private communication from Corinne Fulton of 3R Demolition, Vancouver, B.C.

66 Government organizations consulted with include: City of Vancouver, regional districts (particularly Capital Regional District and Greater Vancouver Regional District), Workers Compensation Board, B.C.Stats. Businesses corresponded with include: First Island Financial, HL Demolition Management, Litchfield Demolition, 3R Demolition, Bear Paw Construction, Demxx Deconstruction Inc., Chew Excavating. Industry associations include: Construction Association, Homebuilders Association, Construction Materials Recycling Association. Professionals include architects, tax lawyer and cost consultant. Non-government organizations include: Northwest Environment Watch (B.C.).

at the impact of a 10 percent change in costs as an example of how a change in government policies could impact the industry.

4.6.1 Labour Costs

In the “1930s house” deconstruction example above, at a wage rate of \$20 per hour, the cost of labour (excluding machine operator time) for deconstruction was \$6,400, one and one-third times the total of sale value of salvaged material plus avoided hauling/tipping costs. Were equally skilled labour available at half that cost, in the order of \$10 per hour, then the sale value of salvaged material plus the avoided tipping costs (\$4,436) would comfortably exceed the deconstruction labour cost (\$3,200). A more realistic wage decrease of ten percent (for labour of equal effectiveness) would result in deconstruction labour costing \$5,760 and reduce the overall cost of deconstruction by \$640.

4.6.2 Tipping Fees

In the “1930’s house” example, the total tipping fees payable on unsorted demolition waste are \$1,900 if the house is demolished. These fees are reduced to about \$475 if the house is deconstructed. In addition, there will be some cost to the disposal of clean wood waste, perhaps \$50 to \$100. An increase of 10 percent in the unsorted waste fee would increase the cost differential between the options in favour of deconstruction by \$142.50.

4.6.3 Sale Value of Material

In the example, it is estimated that about 3,000 board feet of usable dimensional lumber will be produced if the house is deconstructed. This has an estimated sale price of \$300 (for 2x4 and 2x6) to \$420 (for 2x10’s) per thousand board feet, for a total of about \$1,060. A small amount of shiplap (about 300 board feet, or equivalent to about 60 ten-foot lengths) is also produced. At \$340 per thousand board feet this is worth \$100 or so. (It must be stressed that these values are only approximate, and sale prices will depend on quality, quantity, and the immediate market circumstances.)

The project produces about \$1,500 worth of windows, doors, trim, cabinets, fixtures etc. under the deconstruction option. It should be noted that some of this material can be quickly and easily removed without deconstructing the house and thus the assumption that this represents a benefit only of deconstruction may overstate the net cost of the demolition option.

The deconstruction option also produces about \$100 worth of scrap metal from electrical wires, copper and cast iron pipes, gutters, etc. The value of structural dimension lumber, trim, doors and other salvaged material sold, excluding metal, is thus \$2,656. We assume metal scrap prices are unaffected by the residential building deconstruction industry, which provides only a small fraction of metal scrap. A 10 percent increase in the price realized on this material would increase this by approximately \$260. Elimination of sales tax of 7 percent on this material would have an effect worth about \$185.

4.6.4 Holding Costs of Land and Buildings (including time and Financing Costs)

In our example of the deconstruction versus demolition of a 1930's house, the deconstruction option requires 12.5 days and the demolition option 1.5 days. If borrowing costs are 7 percent, and the value of the property is \$125,000, as might be typical in a rural area of the Province, financing costs would be about \$25 per day. On the other hand, if the house is located in an expensive neighbourhood in Vancouver and worth \$500,000, financing costs would be almost \$100 per day.

The difference in cost between demolition and deconstruction in our example, in which deconstruction takes 11 days longer than demolition, may thus range from perhaps \$300 in an area of low property values to \$1,200 in an area of high property values.

In our example, then, a 10 percent reduction in wage costs would have a bigger impact than a 10 percent increase in sale prices which in turn has a larger impact than tipping fees. However, tipping fees are probably the cost most likely to be affected by the policy tools available to government (since local governments are major landfill developers in many areas of the province), followed by sales prices of salvaged materials, with labour costs least affected.

The extra holding costs of the land with deconstruction could vary from zero (if other parts of the project can proceed simultaneously) to a level at which they could be one of the most important factors in tipping the balance between deconstruction and demolition.

5. Some Possible Tax Shifts

It was suggested in the first part of this paper that decisions about renovation, demolition and deconstruction are now being made in the face of significant market price distortions. Many of these distortions are likely to persist for a long time. If so, there is a role for government in shifting the burden of various taxes, charges and regulations in order to encourage the industry to move in the direction it might already have gone if the true costs of activities had been reflected in prices and taxes.

There are a number of examples, especially in Europe, of regulations and fees applied to construction and demolition waste diversion projects, but few true tax shifts, defined in the narrow sense of a tax increase offset by a complementary expenditure increase or tax reduction. (With a true tax shift a fee increase would require reduced fees or exemptions somewhere else).

Below are listed some tax and incentive measures classified under the headings of "revenue increasing" and "revenue reduction or expenditures". In Section 5.3, ways of combining the two types of policy to achieve a true tax shift are discussed.

5.1 Options that Increase Government Revenue

5.1.1. Impose “eco-fees” on some products

Eco-fees are a sales tax, typically applied either as a flat rate per volume or a percentage of the sale price. Applied to construction materials, an eco-fee is intended to increase the price for new material to reflect *all* costs, including environmental impacts of a product resulting from either its use or its disposal (as in the case of eco-fees now charged on paint, batteries and tires).

An eco-fee designed to internalize some of the external costs that we have suggested are connected with production of some materials would raise the cost of new construction materials through. Some research has labelled this a "virgin materials tax".

There are a number of potential benefits from an eco-fee on new materials. If a builder wanted to avoid the additional tax s/he could search out and use salvaged or recycled material. The additional costs of new material would encourage a builder to incorporate more efficient designs that would generate smaller amounts of waste both for present construction and for deconstruction in the future.

As suggested above, one underpriced component of cost is energy use. Peter Russell of the Canada Mortgage and Housing Corporation has prepared estimates of the “embodied energy” of materials used in construction. These estimates would allow us to choose the “primary attributes of building design that are likely to result in a building having least environmental impact over its lifetime.”⁶⁷ There are several major initiatives relating to embodied energy of building materials currently under way.⁶⁸ Research around embodied energy will “help steer the building industry to select materials that are less energy intensive and therefore almost certainly less environmentally damaging.”⁶⁹

If this research can be extended to cover all common building materials, it would represent a tool with which to value the use and disuse (or disposal) of materials.

This kind of research can be seen as an alternative to the preferable policy change of internalizing the true costs of energy production directly in an energy tax that would feed through to all parts of the economy according to the intensity of their energy use.

67 Russell, P. *Relevance of Embodied Energy*

68 Briefly, they are: 1)The Athena project is a computer model used to generate an environmental profile for a building design using embodied energy data. The research is supported by the private sector. 2)The Raw Materials Data Base is run by the Waste Prevention Division of Environment Canada and the Canadian Standards Association. It measures environmental loading of raw materials using its entire life cycle. 3)OPTIMISE is a CMHC-funded project which looks at the environmental loading of single dwellings, particularly wood-frame. It takes into account transportation, construction, maintenance, replacement, demolition and disposal of the materials.

69 Russell, P. *Relevance of Embodied Energy*

A major practical issue is which materials would be chosen for the eco-fee. Lumber is an obvious choice because of its volume and because its use is concentrated in the construction industry. There would necessarily be an impact on the forest industry, and with the forest sector in a state of near crisis, the eco-fee, however small, could be seen as too damaging. As well, Canada's response to the current trade challenge could have the effect of increasing forest use fees

The impact of the eco-fee would depend on its level. As an example, the 1995 house that we looked at (described in detail above) used about 7,500 board feet of framing lumber and about 5,000 square feet of plywood. Taking one square foot of typical sheathing plywood (varying from 7/16 to 5/8 or 3/4 inch thick) as being equivalent to about one-half board foot of lumber, we would find this house containing about 10,000 board feet of lumber. A fee of \$0.01 per board foot of framing lumber used in the construction industry would thus have the effect of increasing the cost of this 1,500 square foot house by \$100, or \$66.67 per thousand square feet.

Administration of an eco-fee could be tied to the PST collection system or designed and collected similarly to eco-fees on batteries and tires. Phasing in the fee over time would allow firms to make adjustments before the full implementation of the tax.

5.1.2. Increase demolition permit fees

Municipalities or regional districts typically set demolition permit fees. Many of these rates have historically been set at low rates in order to cover basic administration costs only. In some jurisdictions, the rates are set as a percentage of the value of the new construction.

In the Municipality of Sidney a permit fee structure has been implemented that is intended to recover more than 100 percent of the expenditures of the Permit & Inspection Division budget.⁷⁰ The developer is charged 5 percent of the building's assessed value as the fee for a demolition permit. (For example, for a house assessed at \$100,000 at the time of applying for the permit, the permit would cost \$5,000.) This resulting fee is very high compared to other municipalities, which typically charge an administration cost-based fee of between \$25 and \$100 for demolition permits. This is a recent change to the permit fee structure. Two and a half years ago, the municipality charged \$50 for a demolition permit and recovered the shortfall in the Division budget through the municipal tax requisition.

Sidney has a flat fee of \$100 to move a building instead of demolishing it. This fee does not support itself in terms of the costs of inspections for the house moving, but is subsidized by the higher demolition permit fees.

By charging the "users" more to demolish, Sidney has shifted the cost of permits and inspections from the general public to the users, and has also created an incentive to relocate or renovate rather than demolish.

70 Sidney By-Law No. 1190

5.1.3. Higher tipping fees

Tipping fees vary widely across the province. Our research has suggested strongly that higher tipping fees are useful tools in encouraging diversion of construction and demolition waste into reuse and recycling. This has been demonstrated by examining the experience of regions where tipping fees have been set to cover some external costs.

There has been some competition between landfill sites in the past, and this is expected to continue. Price competition is desirable if all of the true costs of operating the landfill, including environmental costs, are included in the price. Some contractors now find it cost effective to transport demolition material long distances to under-regulated landfill sites. This is a concern if, as suggested above, road user charges do not represent the true costs of road use. If the full amount of both landfill costs and road use costs were reflected in prices, then there would be no need for a requirement to prevent operators from dumping waste where it is cheapest, perhaps at some distance, instead of at a closer site with higher tipping fees.

Until prices reflect true costs, there is an argument for intervention. Tipping fees could be raised by government operated sites individually as a policy, or a provincial tax or surcharge could be imposed to recognize the long term costs of disposal and to encourage recycling. Another possibility is to raise fees only for construction and demolition waste that is unsorted.

5.2 Options for Expenditure or a Decrease in Revenue

5.2.1. PST Exemption from Salvaged Building Materials

In our conversations with salvage yard retailers, we were encouraged to suggest this policy on the premise that the use of recycled building materials conserves energy and natural resources by reducing the use of new materials. It was felt that even though the competitive advantage is small, simply being able to advertise that the salvaged material was PST-free would help to increase the market share of salvaged construction materials. The PST exemption could also be passed on to products that are manufactured from recycled material (or a certain percentage of recycled material), thereby increasing the demand for used materials.

We suggested above that because so much of the sale value of salvaged material represents value added by the extraction/preparation/marketing process, exemption cannot be justified on the grounds “tax has already been paid”. However, if supporting the salvage industry until it reaches a level of maturity and sustainability is seen as a worthwhile objective, eliminating sales taxes on a small quantity of used material may be seen as a more practical option than imposing eco –fees on a wide range of new materials.

This idea has been proposed in a tax shift bill from the 1999-2000 session in the Hawaii legislature. Among other measures to encourage construction waste recycling, the bill “exempts

from the general excise tax the gross proceeds received from the sale of recycled construction material.”⁷¹

5.2.2. Rebate for Recycling and Reuse

Demolition/deconstruction permits could be issued with a rebate option for consumers who choose deconstruction instead of machine demolition. Once the permit fee is paid, a developer or property owner would be free to choose any contractor for the demolition/deconstruction work. However, if the contractor can show how much waste was diverted away from landfills and incinerators and instead was sold or given away for reuse or recycling, then there would be a rebate on the demolition/deconstruction fee. To maximize the rebate, developers would be encouraged to hire a contractor who can achieve a high rate of salvage or recycling through deconstruction.

Administration of this scheme would be difficult, since it would require records either of (1) the weight of material salvaged/recycled or (2) of the difference between the potential quantity of demolition waste in the building (with no salvage assumed) and the residual demolition waste actually produced after salvage/recycling. One contractor suggested using the figures provided by the 'Notice of Project' form (from WCB) to record the volume of material landfilled and recycled. However, this form is only required for projects costing over \$100,000 or involving buildings over three stories high. A number of stakeholders agreed that the increased administration cost would not be popular. While the more established businesses have already moved toward inventory controls,⁷² it is not realistic to expect accurate compliance from small operators.

5.2.3. Diversion Credit

This is a variant of the previous proposal, except that instead of being credited against demolition fees, diversion credits could be used by a contractor to reduce tipping fees for unrecyclable materials. Again, this would provide an incentive to sort and recycle building materials, but the same kind of administrative problems for small demolition contractors would arise.

5.2.4. Promote and Encourage the Deconstruction/Salvage Industry

We suggested above that the deconstruction industry is in its early stages of evolution in B.C.. Methods of extracting and preparing material, classification and grading, sales and marketing are all still evolving rapidly. Subsidies (perhaps using revenue from tipping fees or eco-fees) could be used to support local salvage suppliers, subsidizing labour costs or the start-up or operating

⁷¹ *State Tax Notes*, p. 717.

⁷² The auto wrecking industry has had inventory controls for years and could be used as model for the salvage industry.

costs for salvage yards, helping to organize marketing in the industry to make it easier for customers to find needed materials. In a similar way the Capital Regional District used tipping fee revenue to create (1) diversion credits and (2) grants to encourage the development of ideas that would divert business waste from the landfill in order to support the start up of recycling operations.

Growth in the salvage materials industry will have some impact on the new building materials industry. Given the small size of the current recycling and salvage industry, however, an acceleration in growth of the industry would result in a very small decline in the volume of new material sales. For the most part, the shift would occur over a longer time period and changes to the new construction material industry would be absorbed with little adjustment.

5.3 Combinations of Expenditure and Revenue

A tax shift, defined as a revenue neutral combination of a tax increase balanced by a tax reduction or new expenditure, could involve any combination of items from the two lists above. This section examines a few pairings that may make particular sense.

5.3.1. PST Exemption and Eco-Fee

A new eco-fee on building materials could be set at a level that would just offset the loss in revenue from the PST exemption. Data on the volume of new and used building materials sold in the province would be needed to make this determination. Because of the disparity in the volumes, a relatively small eco-fee would likely be enough to balance the 7 percent loss on the purchase of used building materials.

5.3.2. Increased Demolition Permit Fees and Rebate for Recycling and Reuse

By increasing demolition fees to offset the lost revenue, the proposal under Section 5.2.2 above for a rebate for recycling and reuse becomes a tax shift. Similarly, the diversion credit under Section 5.2.3 above would become a tax shift if accompanied by an offsetting increase in tipping fees.⁷³

5.3.3. Shift Taxes Away from Buildings and Onto Land

The property tax in British Columbia is really two taxes with very different impacts, a tax on land value and a tax at the same rate on “improvements” (buildings). Many writers have advocated an increase in the first tax, which imposes a small burden on the economy, and a

73 Kibert, C.J. et al. *Implementing Deconstruction in Florida*. Section 6.4.1.2

decrease in the second. It has been suggested that the impact of imposing the two taxes at equal rates is to reduce the intensity of land use.⁷⁴

As noted above, the property tax on improvements may create an incentive for a landowner to rush the demolition of an existing structure to demonstrate its lack of value, particularly if the annual property assessment is imminent, even if the land is going to be held for a period of time before new construction will begin.

A shift of taxes away from buildings would reduce the tax penalty on any kind of building maintenance, expansion, renovation or rehabilitation, but in the same way it will also encourage new construction over renovation. Higher land value taxes, in encouraging more intensive use of land, will discourage the holding of buildings that do not exploit the economic potential of the site they stand on, and in general will increase the “turnover” of buildings on a site. Thus the final outcome of a shift to higher land value taxation is uncertain.

74 A shift to land taxes has been researched and supported by some authors. Julian Greenwood’s report, *The Greening of the Property Tax System* deals with this notion and the advantages of a land-based property tax (also called LVT, or land value tax). Another source for information on this potential tax shift is Alan Durning, *Tax Shift* (NorthWest Environment Watch).

6. Alternative Policy Tools

While tax shifting is a valuable policy tool, in many situations the public has shown itself more willing to accept regulations prohibiting certain activities than tax shifts to discourage them. Thus, for example, the Canadian Centre for Policy Alternatives (CCPA)⁷⁵ is concerned that tax shifts cannot, by themselves, replace regulations in protecting the environment. Often a combination of policy and economic instruments provides the best result. The Centre further warns that tax shifts need to be implemented carefully so as not to lead to unintended effects such as regressivity, loss of jobs and loss of competitiveness.

In the following sections some alternative policies that should be considered are outlined.

6.1 Landfill Bans

As some of the examples above have shown, very high degrees of diversion can be achieved when diversion is the major objective. On the other hand, our examination of the economics of deconstruction in a typical sample home in B.C. suggested very strongly that it is difficult (at best) for deconstruction to compete with demolition. In a similar way a report to the European Commission⁷⁶ found that achieving high recycling rates required not just higher tipping fees or taxes, but landfill bans, which in effect require source separation and some degree of deconstruction. The report's conclusion is that multiple regulations and incentives must be in effect in order for an industry to "progress beyond basic recycling..."⁷⁷.

In B.C. several approaches have been taken:

Bans on *toxic materials* that have already been implemented in various areas of the Province have forced environmental costs, once "externalities", to be internalized by the producing industry or the waste management industry. Landfill bans on toxic substances result in the true costs of handling environmentally damaging material being borne by those disposing of the toxic material in ways other than conventional landfilling. These costs are in turn passed on to the consumer of those goods.

Some areas have banned selected materials commonly found in C&D waste for which a *recycling* market exists. Examples are bans on concrete and metal. These bans (along with similar bans on household recyclables such as paper, plastic, and garden waste) cannot be justified in the same way as bans on toxic materials, which are economically efficient in that they require true costs to be borne by those responsible. However, these "economic" bans have been successful in encouraging the establishment of private recycling facilities.

75 The CCPA recently published a paper, written by Dale Marshall, entitled *Shifting Ground: Policy Brief on the Potential and Limitations of Environmental Tax Shifting*

76 Symonds Group et al. *Report to the European Commission*.

77 Symonds Group et al. *Report to the European Commission*. Section 8.10.

Some bans, such as the Capital Region's *general* ban on demolition waste, in the short term have merely changed location of waste disposal. Demolition waste is burned in a private facility rather than being landfilled in a public one. In the future, however, as recycling of demolition waste becomes economically feasible such bans may be a useful tool.

6.2 Imposing Delays on Demolition

We concluded above that it is very hard to quantify the impact of the extra time taken for deconstruction on the deconstruction/demolition decision, since this impact depends so much on the individual financial and planning circumstances of the developer (rather than the technical conditions of the building). It has been suggested that imposing a minimum period of time between the issuance of the demolition permit or the termination of building occupancy to the beginning of construction may encourage deconstruction by eliminating the time penalty attached to deconstruction – that is, a developer would be required to hold the building vacant for a given period of time (depending on building size and complexity) in the hope that the time is used for deconstruction.

While this policy tool is attractive in some ways, it differs from most of the other policy tools discussed above in being more difficult to justify as a way of correcting a pricing failure brought about by an environmental externality or a failure of government to properly price a service. Imposing a time delay clearly deprives society of the use of the land and building for a period of time, and thus adds a true cost to the process. It can only be justified as a measure to provide encouragement to the deconstruction industry during a period of development. In the longer run it would be desirable for the technology of deconstruction to evolve to allow it to take place as rapidly as possible to decrease its true cost.

6.3 Heritage Preservation Programs

The importance of preserving (which often requires renovating) buildings of historic or aesthetic value has been well documented – heritage preservation gives benefits (“externalities”) to the neighbourhood beyond those enjoyed by the property owner. There is a good argument that it should be encouraged, and there exists a range of programs, from outright legislated protection at the expense of the building owner through voluntary subsidies. The City of Victoria, for example, has in many cases examined (or threatened) the use of “designation” (legislated protection) but has also developed tax forgiveness programs to offset costs incurred in renovation of historic buildings for earthquake strengthening.

7. Conclusion and Recommendations

This report began by outlining a number of reasons why current market prices fail to reflect the true costs of many activities connected with building construction and demolition. Some of these distortions result from a fundamental failure of the market to reflect widespread external costs such as air pollution; some reflect a failure of government to correctly price the services it provides, particularly road services; some, such as the high cost of employing unskilled labour

that would otherwise be unemployed, result from a conflict between social and economic objectives.

We have suggested that taken together these factors represent a significant market distortion, and that this distortion has the effect of shifting to some degree the choice between renovation and new construction, and to a considerable degree the choice between demolition and deconstruction. Almost all the factors discussed lead to a greater reliance on demolition, and less on deconstruction, than should exist.

As a result we have suggested that there is a role for government policy to play in offsetting the distortions in the market. If this is done correctly, then the same set of choices will be made that would occur if private sector operators acted in the face of prices fully reflecting the economic costs of each activity.

Many of the conditions that have distorted choice have existed for some time. Meanwhile, increasing environmental awareness and difficulty with addressing the problem of finding adequate landfill space are making the problem more acute. There is an argument for introducing not only measures designed to correct existing market price distortions but to give the industry a boost to allow it to adjust to where it should be. Thus many of the policy changes suggested in this paper do more than simply offset existing distortions, and in addition would have the effect of encouraging an evolving deconstruction industry to find ways to solve the problem of maximizing the quantity of materials that can be economically salvaged instead of contributing to the waste accumulating in our landfills.

In our view a practical combination of policy changes to enable the deconstruction industry to mature into a preferred option would be the following:

1. Implement a combination of a sales tax exemption for salvaged construction materials, combined with an eco-fee at a very low level to recover lost revenue (see section 5.3.1 above). The exemption could be extended on a partial basis to materials containing a component of recycled material.
2. Begin work with Municipal and Regional governments to standardize demolition fees and create fee structure and rebate systems that encourage deconstruction over demolition (see 5.3.2, 5.3.3, and 6.2 above).
3. Entertain specific proposals from the deconstruction/salvage industry to improve the marketing of re-usable materials. Examples might include development of a web site clearing house to identify needs for, and availabilities of, specialized materials, many of which can only be economically removed if an immediate market is available.
4. Consider amendments to the B.C. Building Code to encourage the use of salvaged material, perhaps by allowing material in sound condition from buildings built before grading was universal to be used in certain roles without re-grading or engineer's approval.

5. Examine WCB and hazardous material regulations as they apply to the deconstruction industry, which contains a number of small firms and operations characterised by lack of administrative expertise, unskilled and temporary labour, and lack of capital.
6. Encourage the introduction of government policies designed to assign the cost of road use to road users rather than the general taxpayer (recognising, of course, that this is a policy with broad implications for many areas of environmental protection and regional planning).

These recommendations are not intended to be exhaustive, but rather to set the ground work for further discussion and analysis. It is clear that the demolition waste industry is at a turning point and examples of good practices in Greater Vancouver and Victoria should be promoted throughout the province. The tax shifts outlined above can be used as tools to help with the process of promoting sound environmental attitudes and create a level playing field for all contractors in the industry.

Appendix: The Underpricing of Road Use⁷⁸

The issue of the correct pricing of the use of roads by automobiles and trucks is worthy of a paper in itself. It is probably the biggest environmental issue facing us, affecting our impact on global warming, the depletion of fossil fuels, and the fundamental patterns of land use in our cities. The underpricing of road use affects a myriad of decisions, and its effect on the choices individuals make about renovation, demolition and deconstruction is but one example of the pervasive effect of the failure to price road use correctly.

Automobiles are a substantial source of water pollution in the form of urban runoff and atmospheric deposition. Urban runoff, loaded with pollutants that leak from or wear off automobiles, is washed off roads and other paved surfaces into surface waters and seeps into groundwater. The paving of land for roads and parking (around 40 percent of urban areas) increases the amount of impervious surface which in turn increases runoff and reduces groundwater recharge. This has the effect of increasing stormwater flows to sewer systems, which can lead to discharges of polluted water when municipal sewer systems become overloaded. Pollutants originating as air emissions from vehicles are also deposited from the atmosphere into surface waters.

Some of the pollutants associated with automobile use include grease, antifreeze, coolant and other engine fluids that contain tiny metal particles and other toxins; copper, lead and zinc from eroded brake pads; ferrous oxide and other metals from body rust and paint; rubber, steel, zinc and rubber dust from worn tires; motor oil and antifreeze spilled or dumped improperly; nitrogen from deposition of nitrogen oxide emissions; salt used on roads; gasoline from leaking underground storage tanks; and oil and other petroleum products that are spilled in transport.

Several studies by the World Resources Institute, the Natural Resources Defence Council, and others have quantified the hidden costs of automobile use in the U.S.⁷⁹ These hidden costs represent the costs or impacts of automobile use borne by society that the individual consumer does not see or pay when choosing to use his or her automobile. In estimating these figures, these studies included the costs of all or some part of the following:

- ◆ Police, fire, ambulance, road construction and maintenance, and other related local government expenditures;
- ◆ Property taxes lost from land cleared for freeways;
- ◆ Air, water, land pollution;

⁷⁸ The source for most of the material in this appendix is: U.S. Environmental Protection Agency, *Opportunities to Improve Air Quality Through Transportation Pricing Programs*. September 1997

⁷⁹ The resulting data from five studies referenced here were compiled by John Holtzclaw, a Ph.D. urban sociologist and regional planner in San Francisco, CA: Ketcham & Komanoff, 1992; Litman, 1992; MacKenzie, Dower, & Chen, 1992; Moffet, 1991; and Vorhees, 1992.

- ◆ Global warming;
- ◆ Noise, vibration damage to structures;
- ◆ Sprawl, loss of transportation options;
- ◆ Uncompensated auto accidents; and
- ◆ Congestion.

Though some of the costs outlined above are paid by automobile users indirectly as taxpayers, the remainder of these costs (or impacts on society through lower quality of life) represents a subsidy to automobile users. That is, the known or direct cost of vehicle use to the individual is *less than* the true or social cost of vehicle use. Thus, the “price” of vehicle use is distorted.

The types of solution that have been put forth include

- ◆ Fuel taxes or other at-the-pump charges, such as “pay-at-the-pump” insurance;
- ◆ Fees based on vehicle use and/or emissions;
- ◆ Roadway pricing, including road tolls, premium tolls, and congestion pricing; and
- ◆ Paying for parking and parking cash-out.

As noted in Section 3.1, introducing policies that address the underpricing of transportation would help the deconstruction and renovation industries. While public understanding of the negative impacts of motor vehicle subsidization may be slowly increasing, there is little immediate prospect of implementation of these measures in British Columbia.

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