UNIVERSITY OF BRITISH COLUMBIA

Best Practice Diversion and End Use Options for Construction, Demolition and Renovation Clean Wood Waste

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April 3, 2013

Report prepared at the request of the City of Vancouver and City Studio in partial fulfillment of UBC GEOG 419: Research in Environmental Geography, for Dr. David Brownstein

Executive Summary

With a goal of informing the City of Vancouver's solid waste management strategy, this report explores the best practice options for the separation and processing of clean wood waste from construction, demolition and renovation activities and the potential end use options for these diverted wood materials. The policy instruments that effectively encourage these actions in jurisdictions similar to Vancouver were also identified. A literature review of academic articles, government documents, and consultant reports informed this research. The recommendations for the City of Vancouver, explored in further detail in the report, are as follows:

- Source separation of wood waste is the most effective diversion strategy. By encouraging deconstruction methods over traditional demolition practices, the ease and efficiency of source separation can be improved considerably.

- The market for recycled and reused construction and demolition waste products needs to be expanded. Establishing demand for these materials can be accomplished through institutional purchasing and encouraging a diversity of end use applications.

- Developing market support infrastructure and expanding the distribution network for reused and recycled building materials is critical for raising their market share. The City's Deconstruction Hub is a great starting point for expanding the local market capacity for reused and recycled wood building materials.

Introduction

Construction, demolition and renovation activities are a significant generator of waste materials in Vancouver and elsewhere. Political, environmental and economic factors have contributed to an increased awareness of the importance of sustainable management of this waste stream. Clean wood waste, which is the single largest component of the construction and demolition sector's waste stream in the region (Kane Consulting et al, 2012), can be diverted away from disposal in landfills and instead be reused or recycled in a vast range of applications. This report, which was prepared for the City of Vancouver's Solid Waste Management Branch in conjunction with City Studio, attempts to answer the following question:

> What are the best known practices for the separation and processing of clean wood waste from construction, demolition and renovation activities, and what is the end use of these diverted wood materials, market-based or otherwise?

Methods

A literature review of academic articles and dissertations, government reports and documents, and consultant reports was undertaken. The geographic regions of focus were British Columbia and other Canadian provinces, the United States, the United Kingdom, and the European Union. Best practice guidelines and examples were determined for the diversion and processing of clean wood waste, as well as the recycling or re-use applications of these materials. Additionally, policy measures that successfully fostered or encouraged these actions in other jurisdictions were identified.

Local Context

The City of Vancouver is presently in the process of adjusting its waste management strategies to ensure that less waste generated in the municipality is destined for disposal. Concurrently, Metro Vancouver, the regional authority, is banning the disposal of wood waste in local landfills by 2015 as part of its Zero Waste Challenge Strategy (Metro Vancouver, 2011). Construction, demolition and renovation activities are a major source of wood waste in Vancouver and elsewhere, and, as a significant proportion of this is currently disposed of in landfills, the implementation of alternative solutions that facilitate the diversion of clean wood materials from the construction and demolition waste stream is imperative. Maracle quantified the composition of demolition, land-clearing, and construction waste destined for two local public landfills (EcoWaste [Richmond] and Vancouver [Delta]); of the wood waste currently disposed, roughly half is untreated or unpainted dimensional lumber while the rest is treated or painted lumber and wood composite, the management of which is beyond the scope of this research. In a 2012 report for Metro Vancouver, Kane Consulting et al project a considerable increase in wood waste from construction, renovation, and demolition activities in the Greater Vancouver region between now and 2041: roughly 470,000 tonnes per year on average between 2005 and 2010 to over 700,000 tonnes annually by 2041. The exact proportion of this waste stream generated within Vancouver is subject to variability in housing markets and other external influences, but it is clear that the capacity for its diversion will have to increase concurrently. Considerable volumes of wood waste are currently recycled in the lower mainland, though it is noted that this typically involves high-volume, low-value end uses such as

landfill cover; while these types of applications are, at the very least, marginally preferable to disposal, they have somewhat limited environmental and economic benefit compared to higher-value recycling and particularly reuse applications (Kane Consulting et al).

Challenges facing the complete diversion of clean wood waste from the construction and demolition sectors are numerous, and include economic, technical, and regulatory impediments, some unique to Vancouver and others more common throughout North America and Europe. Economic challenges to improving wood waste diversion rates in Vancouver include disproportionately high costs for labour and land relative to low materials costs, which incentivize the timely completion of projects and sacrifice the procurement of reused and recycled materials in the design stages as well as the careful separation and reduction of wood waste at the worksite (Kane Consulting et al, 2012). Deconstruction and source separation require improved staff training (Gordon et al, 2003), and multiple waste bins at the work site, which increases hauling costs and project timelines. Additionally, the strength of the housing market creates an inverse relationship between the supply and demand for reused and recycled wood waste, because, despite an associated increase in construction, renovation and demolition activity, “a strong economy makes people less interested in the potential to save money by using used building materials…. In a slow economy the reverse is true: people may be more interested in looking for less expensive used materials, but there are fewer demolitions and renovations” (Kane Consulting et al, 2012, p. 36). Low landfill tipping fees are currently a disincentive for clean wood waste diversion; however in theory the 2015 ban on wood waste disposal will eliminate this particular economic barrier. Other impediments to the increased use

of reused and recycled wood materials in Vancouver, identified in the Kane Consulting et al report, include building code restrictions, a disaggregated supply of used building materials and disconnection between the construction, renovation and demolition stages of a building or lot, a lack of market infrastructure for waste diversion and procurement of used materials, and ingrained cultural preferences for new materials.

While Vancouver's high real estate, and, to a lesser degree, labour, costs are a somewhat unique challenge, there are numerous examples of municipal or higher level governments successfully addressing the challenges discussed above; these will be discussed below following a brief technical overview of the construction, renovation and demolition wood waste stream and the spectrum of potential end uses for reused and recycled wood.

Construction, Demolition, and Renovation Wood Waste Stream

The wood waste stream from construction, demolition and renovation is highly variable in both quantity and quality depending on the source activity, which has significant influence on the most appropriate diversion strategies and end uses to apply. Two sources emphasize that there are differences in the magnitude and composition of the waste streams from new construction, renovation and demolition activities; demolition activities account for the largest share of construction and demolitions waste wood generation in the United States, at an estimated 26.4 million tons of a total 35.1 million tons per year, or roughly 75 percent, in 1998 (McKeever, 1999; Sandler, 2003). In the demolition waste stream, particularly, contaminated wood is of concern for both reuse and recycling: other building materials such as fasteners, drywall, or insulation, as well as paint or chemical wood treatments such as chromated copper

arsenate (CCA), are often present in the demolition waste stream, and given their associated environmental health risks, require separation from clean wood waste during the diversion stage, whether on site or at treatment or sorting facilities (McKeever, 1999). However, distinguishing clean wood from CCA-treated wood for separation can be difficult (Vachon, 2008). Construction wood waste represents a much smaller share of the total stream, and is typically comprised of smaller pieces, or "cut-offs," however it is typically contemporary, clean, and easily separable at the construction site. Wood waste generated by renovation is diverse, "sharing the characteristics of both new construction and demolition wastes" (Sandler, 2003, p. 52), and, particularly for minor projects that do not require permitting in Vancouver, is impossible to accurately quantify (Kane Consulting et al, 2012).

Diversion and Processing

The separation of clean wood materials from the C&D waste stream can occur at a number of stages prior to disposal. Source-separation occurs at the work site, and requires multiple disposal bins to accommodate the various types of materials (clean wood waste, contaminated wood, other recyclables, disposables, etc.), which increases waste hauling costs. Lower landfill disposal fees and the marketable value of reusable or recyclable materials, however, can offset these costs to some degree. For construction activities, source-separation is relatively quick and straightforward, whereas "on-site separation of demolition waste is time-consuming and costly" (McKeever, 1999, p. 35). Careful demolition, or deconstruction, is much more effective at separating clean wood waste from, for example, CCA-treated wood, but it is more time and labour intensive; as a result, Andria Vachon found that deconstruction costs

roughly 17 to 25 percent more than traditional demolition for similar projects in the state of Massachusetts, however it is noted that "increased training and knowledge of deconstruction contractors could decrease the cost" (Vachon, 2008, p. 29). For high-value wood waste, such as structural timbers from non-residential building demolitions, high quality wood flooring, or heritage door and window frames, demolition contractors will often separate and sell these directly from the worksite (Kane Consulting et al, 2012). Later stage separation occurs at reuse and recycling facilities, which employ a range of labour- and mechanical-intensive processes to separate construction and demolition waste materials (Monier et al, 2011; Vachon, 2008). Newer technologies that have been identified as effective at separating clean from contaminated wood waste at waste management facilities include both hand-held X-Ray Fluorescence and Laser Induced Breakdown Spectroscopy instruments, although their economic viability is uncertain (Vachon, 2008, p. 34).

End Uses

There is an incredible variety of end uses for construction, demolition and renovation wood waste that have been demonstrated as sustainable alternatives to disposal. The quantity and quality of the wood waste, which is determined by factors such as the source activity (construction, demolition, deconstruction or renovation), the age of structure and the type of structure (residential, commercial, etc.), has a considerable influence on the suitable end uses, whether reused or recycled, for these materials.

The majority of recoverable clean wood waste generated in the construction, demolition and renovation sectors is more suited to recycling than reuse, and there is a wide

range of potential end use applications for recycled wood. A common application is boiler fuel for electricity generation or district heating applications (Cochran, 2006; Jeffrey, 2011); clean wood waste can be processed into wood pellets, charcoal, gaseous fuel or liquid fuel. Other viable recycled end uses that were identified in the literature include agricultural and landscaping mulch, wood chips, wood composite materials (Cochran, 2006; Ekanem, 2011; Jeffrey, 2011), less common niche-market products such as wood flour, wood-concrete cinder blocks, fire logs, fingerjointed lumber and animal litter (Buehlmann, 2002), as well as "up-cycled" garden planters and furniture (USDA, 2002). A common high-volume, low-value recycling application for clean wood waste is as a landfill cover alternative to soil, however this is regarded by the literature as only marginally preferable to unprocessed disposal (USDA, 2002). There is considerable diversity in suitable end uses for construction and demolition wood waste materials, and as a guideline, the higher the market value of the end use product, the better, but given the variability of the waste stream, it is difficult to assign a "best practice" recycled wood product. Additionally, for most, if not all, recycled construction and demolition wood end uses, it is imperative for environmental health reasons that the wood materials be uncontaminated, highlighting the importance of effective separation strategies.

As a general rule, reusing waste materials is preferable to recycling as it sits higher on the waste management hierarchy and minimizes the financial and energy costs of processing. However, in the construction, demolition and renovation clean wood waste stream, there is relatively little reusable wood by volume. Currently, the reuse of high-value wood materials from demolition and deconstruction activities is quite common; large structural timbers,

particularly from non-residential structures, high-quality wood flooring, window frames and doorframes are often reused in new construction or renovation projects. Kibert and Languell (2000) note that as the supply of salvaged large, old growth timbers has decreased, there has been an increase in market demand for smaller dimension lumber in reuse applications. Deconstruction and source separation practices considerably increase the availability of reusable wood waste relative to traditional demolition, and these reusable materials are typically either sold at the deconstruction or demolition site, or through used building materials retailers, the latter of which are quite limited in the Vancouver region (Kane Consulting et al, 2012), which is an impediment to the expansion of the reused wood market in the city.

Policy Instruments

There are numerous policy instruments available for encouraging the diversion and subsequent reuse or recycling of construction, renovation and demolition clean wood waste. A review of government and consultant documents from jurisdictions with democratic governance structures and similar levels of economic development to Vancouver revealed a range of policy strategies that have effectively fostered these actions. Reports from the California Integrated Waste Management Board (CIWMB, 2002) and Sonnerva International (2006) identified general categories of policies that are effective in conjunction with one another in developing successful construction and demolition waste diversion and reuse or recycling programs: Education and Technical Assistance, Regulatory Requirements, Siting for Facilities, Economic Intervention and Market Development.

Education and technical assistance policies include initiatives that inform contractors and the community at large about reuse and recycling options for construction and demolition waste, as well as training programs for the industry, such as deconstruction methods education for labourers employed in the industry.

Regulatory requirements impose mandatory diversion, reuse and recycling legislation upon the construction and demolition industry; the impending 2015 disposal ban on wood waste in regional landfills (Metro Vancouver, 2011) falls under this category. As this is essentially a blanket measure that will ensure the diversion of clean wood waste from construction and demolition activities, there will be little else required in the way of regulation in Vancouver. Increased enforcement of existing regulations governing illegal dumping, for example, may be required in the region once the 2015 disposal ban is enacted.

Informed siting of waste recycling and reuse facilities is important as it should consider ease of access for materials delivery and procurement, but also community concerns, as processing facilities for recycled wood materials, in particular, can be “unpleasant, dirty, noisy operations” (Vachon, 2008, p. 64). The siting for reused building materials infrastructure (retailers and warehouses) is much less problematic.

Economic interventions in other jurisdictions often include landfill tipping fees or lower recycling rates relative to disposal rates (CIWMB, 2002), both of which will be non-issues in Vancouver following the 2015 disposal ban; other economic intervention policies include deposits or “Extended Producer Responsibility” (EPR) fees, such as those currently levied on electronics and vehicles, which, through an up-front charge, essentially transfers the burden of

waste management “upstream towards the producer and away from municipalities… (and) provide(s) incentives to producers to incorporate environmental considerations in the design of their products” (Sonnerva International Corp., 2006, p. 9). Conversely, financial incentives such as tax credits for the donation of used building materials can encourage diversion of reusable wood waste (Kane Consulting et al, 2012).

Market development policies encourage the establishment of market demand for reused and recycled construction and demolition wood materials, as well as the infrastructure required to support the end use markets. Institutional purchasing arrangements for municipalities are effective at establishing and sustaining a consistent demand for reused and recycled wood waste products: “the goal should be for the city to be its own best customer” (CIWMB, 2002, p. 6). As noted in the Kane Consulting et al report, the distribution network for used building materials in Vancouver is quite limited, which highlights the potential need for municipal intervention in developing market support infrastructure.

Recommendations

The literature review detailed above has identified effective diversion strategies and end use options for clean wood waste from the construction, demolition and renovation sectors. For diversion and separation of clean wood from this waste stream, source separation is the most effective strategy; discerning clean wood from contaminated wood waste is easiest at the worksite, particularly in new building construction projects and deconstruction teardowns. The city should further engage in efforts to encourage deconstruction methods, a process it has begun with the recent *Advanced Permit for Deconstruction*. Informational campaigns regarding

this novel initiative as well as those promoting the sustainability benefits of reused and recycled wood products would raise their profile and improve the public perception of such materials. Fostering a market for recycled wood products is absolutely vital. Institutional purchasing by the City of Vancouver would be effective for developing an economy of scale for recycled wood materials; this could apply to materials for anything from new city buildings or renovations to landscaping mulch at city parks. Encouraging a plurality of end use applications would increase and stabilize the demand for recycled wood; there is no single best practice end use for construction and demolition wood. With regards to reused wood materials, greater market support infrastructure needs to be implemented in Vancouver. The currently conceptual City of Vancouver "Deconstruction Hub", which is basically a warehouse and market for reusable deconstructed waste materials, has the potential to be an invaluable local resource for the reused wood materials market. As disposal of construction and demolition wood waste is no longer an option in Metro Vancouver, while the absolute volume of waste generated in the city is projected to steadily increase over upcoming decades, the adoption of the above recommendations or similarly effective diversion measures is critical for improving the efficacy the City of Vancouver's solid waste management strategy.

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