

Construction & Demolition (C&D) Waste Practices

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SEEDS PROJECT FINAL REPORT

Construction & Demolition (C&D) Waste Practices

Information Collection Phase



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1. Executive summary

C&D waste reduction and diversion is an integral part of UBC's Zero Waste Action Plan, which in turn is a high priority for Campus Sustainability.

It is estimated that UBC Project Services manages about 60-80 "special" projects per year. These are typically renovation projects that fall between large construction projects, and small projects. Large projects generally have good waste tracking due to the requirements in LEED and REAP green building rating systems to which most large projects must conform. Waste from small projects is tracked because it is managed by UBC Building Operations. However, waste diversion is not tracked for the "special" projects. The small size of the projects and private contractors involved makes detailed waste tracking more cumbersome.

In support of UBC's Zero Waste Action Plan, to decrease C&D waste disposal and increase waste diversion for medium sized renovation project with smaller contractors, the purpose of this initiative was to develop a practical waste tracking and reporting method; and promote C&D waste reduction and diversion for contractors. The study is consisting of two separate parts:

1. Information Collection from contractors
2. Research and identify solutions for waste tracking/reduction and diversion for this type of projects.

This report reflects the results of the first part of the study. In this part general contractors and demolition/waste management subcontractors working on-campus were interviewed regarding their waste management and waste tracking practices and their methods and strategies for waste reduction and waste diversion.

The key findings in this study are as follow:

- General contractors are not very aware or concerned about waste management as they assign demolition/waste management sub-contractors to take care of demolition waste.
- Tracking waste is easy by analyzing the waybills from landfills/transfer stations/recycling facilities, yet contractors do not consider it to be necessary in "special" projects
- There is usually not enough space on-site to set up separate bins, but waste can be categorized in different piles, cans, plastic bags
- Waste is not categorized by their quality
- Reusing is rare due to the following reasons: Owners/architects prefer new materials; salvage materials might not meet required quality or quantity; in some cases, it is against BC construction codes; lack of storage area; lack of market; time constraints.
- Materials which are not usually diverted are: Small amounts of waste, plastic, mixed small pieces of waste, bonded systems, food waste.

The following recommendations are proposed as a result of this study:

- Mandate waste tracking and a minimum waste diversion in the general contract, proved by waybills
- Provide standard and easy form to fill in both electronic/online and hardcopy formats.
- Educate Contractors and workers through some courses
- Provide small size bins, which clearly shows the type of waste that should put in them
- Expand organic composting for large construction sites



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- Conduct studies on un-recyclable waste, e.g. plastic, mixed small pieces of waste, bonded systems
- Hire one demolition sub-contractor for multiple projects on-campus
 - o Carry waste from various site together
 - o Reduces dump fees by reduced cost for larger quantities and also separated loads
 - o Less space is needed on campus for setting up bins
- Expand the transfer station on-campus to accept C&D waste of “Special” project
 - o Promote waste separation on site
 - o Promote waste categorization based on the quality
 - o Keep small quantities until they reach an acceptable amount
- Provide a list of preferred sub-contractor list to general contractors.

Preferred sub-contractors should:

- o Have high waste diversion records
- o Report waste generation and diversion rates, supported by waybills
- o Train workers, preferably through UBC courses
- o Work with preferred transfer station and recycling facilities

It is recommended that preferred sub-contractors:

- o Use pick-ups for small loads rather than trucks
- o Use, sell or donate reusable materials
- o Categorize waste based on quality
- o Use innovative methods for unrecyclable materials
- o Separate waste on-site
- o Take each type of material to designated recycling facilities/transfer stations
- o For small quantities of waste:
 - Take them as mixed load to transfer stations with high diversion rate
 - Store them until it reaches to an amount that fills a truck/pick-up → potentially in campus transfer station



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2. Introduction

UBC is striving to be a zero waste campus by 2030. C&D waste constitutes a considerable amount of UBC's waste; hence, it is crucial to understand current amount of C&D waste generation and diversion rates. Such study provides required data for Campus Sustainability to be able to plan for next steps toward Zero C&D Waste.

It is estimated that UBC Project Services manages about 60-80 "special" projects per year. These are typically renovation projects that fall between large construction projects (e.g., construction of a new building), and small projects (less than \$50k, whose waste is managed by Building Operations). Large projects generally have good waste tracking due to the requirements in LEED and REAP green building rating systems to which most large projects must conform. Waste from small projects is tracked because it is managed by UBC Building Operations. However, waste diversion is not tracked for the special projects because:

- The waste is managed by small, private contractors – not by UBC
- The projects are typically not required to conform to LEED or REAP

The small size of the projects and contractors involved makes detailed waste tracking more cumbersome for the contractors. In the past several years, a tracking sheet was developed to help contractors track waste on a voluntary basis – however it was not successful. There are concerns about increasing the burden on contractors, and increasing their costs that could get passed along to faculty clients who are funding the renovation projects.

In support of UBC's Zero Waste Action Plan, to decrease C&D waste disposal and increase waste diversion for projects that fall outside of LEED and REAP green building systems. The purpose of this initiative was to develop a practical waste tracking and reporting method; and promote C&D waste reduction and diversion for contractors. This project is divided into two main themes:

1. Collect information from construction contractors and waste management companies, on "special" projects regarding their current.
2. Research and identify solutions for waste reduction and diversion, specifically for this type of medium sized renovation project with smaller contractors.

This report contains the first part of the study i.e. data collection. The focus of this part of the study was on gathering the following information from general contractors and demolition/waste management sub-contractors:

a. Waste management and waste tracking practices

- Collect data that will assist UBC in estimating the total waste generation and typical waste diversion rates from special projects
- Identify the most prevalent types of waste materials for different project types
- Determine how waste is typically collected on site, and where do the different materials go for processing or disposal.
- Identify current waste generation and diversion tracking methods (if any) used by contractors and other service providers
- Recognizing tracking methods that can be practical and have minimal cost impact to contractors
- The way in which UBC can help contractors to track and report waste

b. Waste reduction and diversion practices

- Collect data on typical waste diversion rates and methods from special projects



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- Finding key barriers for waste reduction and diversion
- Opportunities to increase waste diversion
- The way in which UBC can help encourage waste reduction diversion

3. Methodology

In the first phase of the study small, private, general contractors who were working on the “special” projects on campus were interviewed in regard to their current waste management practices and also about their challenges to track and divert waste. The results of interviews with general contractors are summarized in section 4. Details of these interviews can be found in Appendix 1.

A major finding in the first stage of the study was that many of general contractors are not so much aware of or concerned about demolition waste practices in their projects. It is due to the fact that they assign demolition/waste management sub-contractors to take care of demolition waste. Hence, in the next step of the study some of demolition sub-contractors were interviewed regarding their waste management practices. Section 5 summarizes the result of interviews with demolition/waste management sub-contractors. Appendix 2 contains details of these interviews.

We also asked contractors to fill out a form which indicates the quantities of waste generation and waste diversion for each type of material. Many of the contractors refused to fill this form or did not provide accurate data. They stated that, as they were not asked to fill this form from the beginning of the project, they have not tracked the waste and have not asked the subcontractors to keep and deliver receipts from transfer stations or landfills. Moreover, most of the contractors considered filling this form to be an unnecessary extra work load which wastes their time. The results of these forms were analyzed in section 6. The goal of these analyses is to estimate total waste generation and typical waste diversion rates for “special projects”.

4. General Contractors Interview Summary

The summary of the interview with general contractors is provided in this section. In order to have interview details, we encourage the reader to see Appendix 1.

4.1. Waste Tracking

4.1.1. How waste is typically collected on site, and where do different materials go for processing or disposal?

- *Demolition and transferring waste to transfer stations, landfills, or recycling companies are usually conducted by demolition or waste management sub-contractors, unless the project is very small and does not produce considerable amount of waste. In these cases general contractors would usually rent waste bins and take the responsibility of waste management themselves.*
- *For small projects that produce minimal amount of waste, there is not enough motivation for separating waste. Sometimes all the waste would go to one commingle bin and will be separated off-site, as much as possible, by waste management companies or in the transfer station.*
- *Some companies have simple methods to separate small quantities of waste on-site and carry them separately to the dumps, e.g. using plastic bags or simply separating them in different piles on-site.*



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4.1.2. Is the amount of waste that is generated and recovered measured in your project? (How much waste is generated? How much of it is recycled? What metrics do you use to assess the amount of waste generation (kg or lbs per Sq.ft or dollar value of project))

Who is responsible for gathering that data? (Is waste diversion measured by you (contractor), waste haulers, processors or waste transfer stations?)

- Contractors claimed that although it is easy to track waste, there is not enough motivation or requirement to track the waste. Only LEED projects, or projects that have a requirements from owners or architectural firms, track their waste.
- As in many of the projects, demolition/waste management sub-contractors are responsible for delivering waste to transfer stations, many of the general contractors are not aware of the exact amount of generated waste. However, owing to their work experience, they were able to give a rough estimation of the amount of waste that will be produce in their projects.
- Waste is usually measured by weight (tones or Kg). Transfer stations, landfills, or recycling companies weigh the delivered waste and give waybills to haulers. However, some of the demolition/waste management sub-contractors do not keep the bills or do not provide it to contractors, unless contractors require that. Some of the contractors ask for waybills to check the accuracy of demolition and waste management costs.

4.1.3. How many separate bins you have on site to collect different types of waste? Do you differentiate Construction and Demolition waste? Do you separate Reusable and recyclable materials?

- Except for large projects (e.g. Ponderosa commons, which is a LEED project), usually there is not enough space in construction sites to set-up separate bins for different types of waste. Hence, waste is gathered in bags or in separate piles and will be loaded in bins that come into the site one at a time. They may also directly load the piles of waste into trucks/pickups.
- Even in LEED projects, waste is not usually categorized by its quality. Only very little amount of materials/components that can be reused on site, or can be sold/given to somebody for free are separated.
- General types of bins are: metal (valuable metals such as copper is separated), drywall, wood, Commingle waste (wood, dirt, excavated soil, cardboard, Concrete, Plaster/cement, insulation, acoustical ceiling tiles, carpet tiles, food waste). Depending on the amount of waste that is generated, each of the materials in the commingle bin (e.g. Cardboard, Concrete, insulation, and Block/Brick) might be separated, but since usually there is not much of them, they would be simply separated in piles rather than bins.
- Construction and demolition waste are not usually differentiated. However, in many of these projects demolition sub-contractors deals with demolition waste, while general contractors are responsible for construction waste, especially in small size projects. Construction waste is less separated as it has a less quantity than demolition waste. Usually, a waste management company/hauler sub-contractor carries construction waste to landfills/transfer stations.

4.1.4. What types and how much of waste will be reused (in the same or different function), recycled, or sent to landfill?

- Many of contractors do not deal with the end life of materials and their recycling percentage. Hence, they are not fully aware of end of life scenario of each type of waste.

4.1.5. Is there any building code, requirements from transfer station or UBC Campus that you have to follow in regard to waste management?

- Some of contractors mentioned that UBC promote sustainable practices such as recycling, but there is no specific



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requirement for them in the contract to track waste or recycle a particular percentage of C&D waste.

- *Almost all contractors were aware of extra cost for mixed waste in transfer stations and specific requirement for hazardous materials.*
- *They also mentioned that they should pay extra charge, if they have drywall in their mixed load.*

4.1.6. What are the major obstacles to waste tracking for your company? (e.g. it costs, time requirement, or other factors)

- *Most of contractors claim that it is easy to track waste, but as it is not required early in the contract, there is no motivation to track waste. Some of them claimed that tracking waste requires extra time and effort.*

4.1.7. How do you think UBC can help you in tracking and reporting the amount of waste (e.g., a web based tool)?

- *Almost all of the contractors suggested that UBC should mandate tracking of waste early in the contract and demand providing waybills receipts as a proof*
- *Provide a standard and easy form to fill in both electronic/online and hardcopy formats.*

4.2. Waste Diversion:

4.2.1. Do you use the recovered waste in your own projects or sell them? What is the reason for your preference? (Costs, Quality or quantity of materials, customers, code requirements, storage requirement, time, etc.)

- *Except for small pieces that can be repurposed for functions such as backing, waste is typically not reused in the same project. In a few cases materials were reused due to the following reasons:*
 - *The owner/architect has requested that (e.g. University Centre – Scott Special Projects)*
 - *Materials were in a good condition (University Centre and Geography building seismic upgrades)*
 - *Materials were valuable (Timbers in old Ponderosa Buildings will be reused in the ceiling of new cafe).*
- *The following materials/products are the ones that are being reused in some projects: timber, door & window frames, cabinets, door handles, locks, carpet tiles, ceiling tiles, bathroom tops, insulation, lighting fixtures, soil, roller blinds, baseboards, white boards, ceiling steel T-bars, pipes, electronic transformer, and cable trays.*

4.2.2. Does sending waste to landfills or recovering it have different time/financial requirements or benefits for you? (Do you see any economic value in C&D waste recovery?)

- *A few contractors pointed out that reusing prevents the extra cost for buying new materials and it offset the cost that is spent for deconstructing and cleaning of materials.*
- *Most of general contractors claim that as demolition subcontractors are the owner of materials, hence recycling does not have a considerable benefit for them. In a few cases contractors mentioned that waste diversion reduces demolition/hauling contract fees as there is some economic value in waste recovery for demolition/waste hauler subcontractors through reduced disposal fees or through selling the scrap metal.*

4.2.3. Who are your major customers for the recovered materials? (Get their contact if it is possible)

- *Demolition subcontractors/waste haulers take materials to recycling facilities or landfills. Hence, most of contractors are not fully aware of their major customers for recycled materials*



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4.2.4. What are the key barriers to waste reduction and diverting in your projects? (e.g. lack of knowledge, cost, lack of infrastructure, time, storage space, customer, or other factors)

Recycling:

- There is not much economic value in recycling (Time vs. gaining)
- There is not enough space to setup different bins

- Educating the staffs
- Gathering waste in not transparent plastic bags prevent workers to see what is inside them
- Finding recycling facilities with decent price for each type of waste
- Unrecyclables: Packaging, plastic and Styrofoam, small pieces of mixed materials

Reusing:

- In renovations materials are old and not in a good quality
- Owner requires new materials
- Storage area is expensive
- Sometimes it is against codes to use old materials (e.g. reusing structures or old round door handles)
- Old materials might be outdated and not compatible with new technology
- Salvaged materials might not fit in new design (size, length, color, etc.)
- Processing materials for reusing in the same project is time consuming and may result in delays the project schedule.
- For materials such as tiles, if some of them need to be replaced, it is costly and difficult to find new tiles that match old ones.
- Finding customer for salvaged materials (contractors mentioned they might give it to anybody who wants it for free.)
- Materials might be damaged through demolition/deconstruction

4.2.5. What are some opportunities to increase waste recovery? (What would need to happen for help you to achieve 75% or higher waste diversion?)

- Educating and policing (charging) staffs
- Changing the laws and regulations (make recycling mandatory)
- For projects with high diversion rates: Reduce plastic content, and packaging.
- Repurposing old materials in some functions that are not visible (i.e. does not affect the aesthetic requirements)
- Provide monetary incentives

4.2.6. How can UBC help encourage waste reduction and diversion? (e.g. on campus transfer station not really necessary)

- Mandate waste diversion and specify the minimum recycling percentage for each type of material/project in the contract and ask for waybills to prove their claims.
- Extend organic compost collection programs to large construction sites (e.g. Ponderosa Commons).
- Conduct studies on items that typically are not typically recycled and provide facilities to address these materials (e.g. plastics, bonded systems, small size mixed waste, etc.)
- Create an online list of recycling companies that contractors can work with
- Provide a local dump near UBC to take responsibility of sorting waste and even maybe hauling bins when they



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are full (suggested by Brendan Reid – Holaco Construction – CEME Lab)

- Facilitating the access of trucks and pickups to the site

5. Demolition Sub-contractors Interview Summary

5.1. Waste Tracking:

5.1.1. How waste is typically collected on site, and where do different materials go for processing or disposal?

- Their method highly depends on the project and its site conditions; however, they all stated that they try to separate materials onsite and transfer them to the related recycling stations
- Depending on the size of projects, different types of waste may be collected in separate bins or piles
- Small amounts of waste are not usually carried in separate trucks/pickups. However, they may try to carry them in separate piles or stack them on the top of each other in one truck.
- Unloading the waste one by one and weighing the truck each time is time consuming and costly, so that they sub-contractors prefer to unload the waste as a mixed load and pay the extra money to the station to separate the mixed waste.

5.1.2. Is the amount of waste that is generated and recovered measured in your projects? (How much waste is generated? How much of it is recycled? What metrics do you use to assess the amount of waste generation (LSB per Sq.ft or dollar value of project)) Who is responsible for gathering that data? (Is waste diversion measured by you (contractor), waste haulers, processors or waste transfer stations?)

- 3 out of 4 sub-contractors mentioned that they track the waste and keep the waybills for their own purposes (e.g. estimating the cost in future projects), regardless of general contractors request. However, they all claimed that the general contractors usually ask for the bills only if it is a LEED project.

5.1.3. How many separate bins you have on site to collect different types of waste? Do you differentiate Construction and Demolition waste? Do you separate Reusable and recyclable materials?

- Drywall, wood, precious metals, metal, concrete, cardboard, and garbage are the general types of waste bins. However, the number of bins is highly depended to the project conditions and available space.
- They usually do not have space for more than 2 separate bins. Hence, they will keep the waste in separate piles and put them in the bins which come in one at a time or load the piles directly into the truck.
- They usually only deal with demolition stage. However, they stated that general contractors have less interest in separating and recycling waste. They prefer to get rid of waste as soon as possible to be able to finish the project efficiently and in a timely manner. Hence, most of the times construction waste, which is handled by general contractors, would be carried as mixed loads, especially for small projects.
- One contractor (Ray Grendus, Fraser Trucking & Tractor Ltd.) mentioned that they categorize wood waste based on its quality and try to keep wood waste clean in order to sell it in higher prices.

5.1.4. What are the major obstacles to waste tracking for your company? (e.g. it costs, time requirement, or other factors)

- Tracking waste is not mandatory
- It can be costly as they have to dedicate an employee to keep the track of bills
- As bidding pricing is tight, they will not win the bidding if they raise the price for tracking or recycling waste



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- *Difficulty of estimating the recycling percentage in mixed loads*
 - *Knowing the exact weight of waste for the loads that are transferred to the recycling facilities which don't have scale.*
- 5.1.5. Is there any building code, requirements from transfer station or UBC Campus that you have to follow in regard to waste management? (For separating, recovering, etc.)
- *Some materials such as drywall and cardboard are not accepted in mixed load in transfer station*
 - *Using legal dump stations*
 - *Hazardous materials*
 - *LEED project demand tracking waste and a specific recycling percentage; however, they are not very strict about checking the accuracy of their claim*
- 5.1.6. What types of mixed waste materials won't be accepted in transfer stations and landfills?
- *Drywall and cardboard*
 - *Hazardous materials*
 - *They are less strict about wood, but the regulations are changing and they will limit the amount of permitted wood waste*
- 5.1.7. How do you think UBC can help you in tracking and reporting the amount of waste (e.g., a web based tool)?
- *Demand a specific recycling percentage in the contract*
 - *Checking the accuracy of their claims by asking for submitting the bills, so that they cannot manipulate the information*
 - *Having their own transfer station and haulers to make sure the data is correct*
 - *Make sure that contractors work with demolition subcontractors which have high recycling percentage in their resume, even if it increases the bidding price*

5.2. Waste Diversion:

- 5.2.1. What types and how much of waste will be reused (in the same or different function), recycled, or sent to landfill?
- *3 out of 4 contractors claimed that material reuse is very minimal in their projects and only happens if general contractors ask for it or if it is mentioned in the drawings. It includes mainly doors and cabinets which are in a good condition.*
- 5.2.2. Do you gain money recovering waste? Does it worth your time? Who are your major customers for the recovered materials?
- *Separating waste and recycling offset the extra time and cost of waste diversion, as it reduces the dump fees; however, it is not considerably profitable as they cannot increase the bidding price.*
 - *One contractor (Dano Debney - Aerostars Contracting Ltd) claimed that they use craigslist to sell materials for reuse or giving them for free. He stated that it not only can be considered as a source of income, but also reduces dumping fees.*



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- The transfer stations and dumps reduce the fees for higher monthly volume of waste
- They choose the transfer station/recycling facilities based on their prices.
- Private facilities have more interest in diverting waste as they look at it as a business, while governmental facilities have less motivation to recycle as much as possible.

5.2.3. Where do you separate the waste (on-site, in transfer stations, in landfills, etc)?

- They usually separate waste onsite and try to have a demolition plan (e.g. 1st. Ceiling, 2nd. Walls, 3rd. Floors, etc) so that they can only deal with one type of material at a time.
- Small amounts will be mixed and transfer station employees separate them.

5.2.4. Do you have any system for separating small quantities of waste? (Special bins, transferring waste of more than one project to landfills, etc.)

- Layering the stacks of different types of materials (big pieces) in one truck load or use garbage cans for small pieces (The material can be seen in the can as oppose to opaque plastic bags)
- Separating screws with magnet
- Storing small amounts in their company yard or their house garage until it reaches enough quantity to sell
- Using trailers and pick-ups instead of trucks.

5.2.5. Can packaging and plastic be recycled?

- They did not know of any facility who accept soft plastic for recycling

5.2.6. What are the key barriers to waste reduction and diverting in your projects? (e.g. lack of knowledge, cost, lack of infrastructure, time, storage space, customer, or other factors)

- Time
- Storage space for keeping waste until it become a full load
- BC Building codes does not allow reusing lumber as structural material
- There is no market for reusable materials even if they are not old
- Economic barriers (its more economical to dump all the waste rather than separate waste)
- Difficulty of the process (separating waste, carrying them separately)
- Because of the bidding process they cannot increase the price to recycle more
- Unrecyclable materials (glass, plastic, isolation, flooring)

5.2.7. What are some opportunities to increase waste recovery in small projects? (What would need to happen for help you to achieve 75% or higher waste diversion?)

- Have a storage area for waste until it reaches enough quantity to fill a truck
- More strict regulations
- Change the BC codes to reuse lumber as structure instead of recycle (Currently they are shipped outside of Canada)
- Dedicate employees in transfer stations to separate small mixed waste loads.



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5.2.8. How could UBC help encourage reduction and diversion of waste? (e.g. on campus transfer station)

- Have a transfer station nearby campus and provide the bins and check the proper use of it.
- Mandate specific recycling percentage and onsite waste separation
- Educate workers to know what can/can't be recycled
- Provide more space for setting up the bins.

6. Quantity Sheets Analyzes

6.1. Demolition Waste

Project / Material	FNH		Uni. Centre		Buchanan B		Geography		Sauder Phase III	
	Total Tons	Recy. %	Tons	Recy. %	Tons	Recy. %	Sqft	Recy. %	Tons	Recy. %
Drywall	24.57	?	19.37	100			1350	100	9.1	100
Concrete	0.00	?	92.67	100	0.45	100			132	100
Wood	0.00	?	3.00	85	0.45	100			-	-
Metal	9.59	?	9.18	100	0.23	100	500 Lnft	100	20.65	100
Mixed waste	12.44	?	8.11	94					60.55	22.5*
Insulation							540	100	-	-
Elec. Conduit							200	100	-	-
Corrugated Board					0.01	100			-	-
Light Fixtures					Reused				-	-
Flooring (wood)									-	-
Total Material	46.6		132.34		0.23				222.3	
Project Cost (1000 \$)	1,100		4,122		69		900		57,150	
Total Recy.	34.16	73	124.23	93.87	1.14	100		100	175.62	79

* Wood in the mixed waste load is recycled.

6.2. Construction Waste

Project / Material	Ponderosa Commons	
	Tons	Recy. %
Drywall	-	-
Concrete	-	-
Wood	-	-
Metal	-	-
Mixed waste	-	-
Total Material	1212.41	
Project Cost (1000 \$)	120,000	
Total Recy.	1100.18	90.7



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7. Discussion

- Except for the projects in which there are very little amounts of waste, demolition sub-contractors are responsible for demolition waste, while general contractors mainly take responsibility of construction waste. They may rent bins and hire a hauler from waste management companies.
- Demolition subcontractors/waste management companies would gain the potential economic benefits of selling old materials. Hence, they are more concerned about separating and diverting waste in the most efficient way. By contrast, many of general contractors are not fully aware of or concerned about different scenarios and costs/benefits of end of life of different types of waste. Some general contractors believe that separating waste does not worth their time.
- Due to the higher quantity of demolition waste and also because demolition companies are more concerned about the benefits of separating waste, demolition waste is usually separated more carefully onsite. As opposed to construction waste which usually carried to landfill as commingle waste.
- Some of the demolition subcontractors stated that they separate small quantities of waste in one truck/pick-up, by plastic bags/garbage cans or simply by putting them in separate piles. However, unloading the waste one by one and weighing the truck each time is time consuming and costly. In this case delivering waste as a mixed load and pay the extra money to transfer stations to separate the mixed waste might be a better option.
- Many contractors stated that they can track waste easily by requesting waybills from demolition sub-contractors/waste management companies. However, they usually do not have enough motivation/requirement to do so, except for LEED projects. Most of subcontractors stated that they keep waybills for their own purposes, but contractors generally do not request for them, unless it is a LEED project.
- Waste is not usually categorized by its quality.
- Contractors/subcontractors stated the following points as major obstacles for waste diversion:
 - Small pieces of mixed waste
 - Materials which are difficult to separate (e.g. because of adhesives, nails, etc.)
 - Unrecyclable materials (Styrofoam, plastics and wrappers in packaging)
 - There is not much money in recycling
 - Lack of space on site to set up separate bins.
 - Educating the workers
 - Non-transparent garbage bags, used for small amounts of waste, can result in mistakes in waste categorization
 - Finding proper recycling facilities for each type of waste with decent price
 - Separating food waste (In large projects)
 - Competitive bidding fees among demolition sub-contractors
- Materials are not usually reused in the projects, unless it is requested by the owners/architects.
- Major obstacles stated by contractors for material reuse are:
 - Old materials in renovation projects are mainly not in a good condition to be reused
 - Owners usually prefer new materials
 - Storage area is expensive/inaccessible
 - Sometimes it is against codes to use old materials (e.g. structures)
 - Old materials might be outdated and not efficient enough in terms of energy consumption



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- Salvaged materials might not fit in new design (size, length, color, etc.)
- Processing materials for reusing in the same project may be time consuming and may result in delays in project schedule.
- Finding customer for salvaged materials
- Materials might be damaged through demolition/deconstruction

8. Recommendations

8.1. Campus Sustainability:

- Campus Sustainability can support, promote, and conduct studies on innovative method for diverting unrecyclable materials (e.g. plastics, bonded systems, small size mixed waste, etc.) and best practices for waste management, i.e. waste tracking/diversion strategies. These studies can be done in collaboration with other active organization in the region such as Metro Vancouver.
- Campus Sustainability can offer courses to educate contractors/workers on waste management. Attending these courses can be considered as an asset for preferred contractors list. The courses can contain materials such as best practices of waste management, preferred recycling facilities or transfer station, how to fill the waste tracking form, etc.

8.2. Building Operations:

- Small projects on campus can have shared bins and same demolition sub-contractor. In this case demolition sub-contractor can benefit from reduced dump fees for higher waste quantities and consequently decrease the bidding fee.
- Building Operations can extend organic compost collection programs to large construction sites.
- Building Operations can have a transfer station close to the campus that has high preference on separated waste. The transfer station stores different types of waste separately, until they reach an acceptable quantity. Then each type of material should be carried to the designated recycling facility. This transfer station can also promote separating waste based on different qualities.

8.3. Project Services/Properties Trust:

- Project Services/Properties Trust should mandate tracking waste and a minimum recycling percentage, based on the project type, early in the general contract and demand providing waybill receipts as a proof.
- In order to increase diversion rate, Project Services/Properties Trust should mandate contractors to submit their demolition/deconstruction plan before starting demolition stage.
- Project Services/Properties Trust can provide contractors with an easy waste tracking form to fill out, in both electronic/online and hardcopy format would help them to track waste more easily. A possible option for that is incorporating Green Halo¹

¹ Green Halo Systems is a user-friendly and intuitive; web based waste management software solution. Green Halo provides real time, and historical data, charts, graphs and reports. The software is marketed by Light House, a sustainable consultant company.



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- Project Services/Properties Trust can demand small separate cans/bins to collect small quantities waste. The cans/bins can also be used to carry waste separately in one truck/pick-up. Materials inside cans/bins should be easily identifiable for workers. Building Operations can provide cans/bins.
- Project Services/Properties Trust should request material reuse, whenever it is possible
- Project Services/Properties Trust should make sure that contractors work with dumps/transfer stations that have high recycling rate; weigh waste; and issue bills.
- Project Services/Properties Trust can provide a list of preferred demolition sub-contractors for general contractors and a list of preferred transfer stations/recycling facilities for general contractors and demolition sub-contractors.

8.3.1. Preferred Demolition Subcontractors List

- **Required practices:**

- Prove a high waste diversion records in their previous practices.
- Reports the waste generation rates and recycling percentage, supported by waybills at the end of project.
- Train workers on best practices of deconstruction/demolition and also separating waste.
- Work with preferred transfer station and recycling facilities

- **Preferred practices:**

- Separate waste on-site and take each type of material to designated recycling facilities/transfer stations
- For small quantities of waste:
 - Using pick-ups rather than trucks
 - carry them as mixed load to transfer stations with high diversion rate record
 - Store them until it reaches to an amount that fills a truck/pick-up
- Use, sell or donate reusable materials
- Categorize waste based on their quality
- Provide innovative methods for dealing with unrecyclable materials



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Appendix 1: General Contractors Interviews

Contractor: Mike Fisher
Date: 06/18/2013

Project: University Centre
(Seismic improvement)

Waste Tracking:

1. How waste is typically collected on site, and where do different materials go for processing or disposal?
 - Demolition has been done by Pacific Blasting & demolition
 - Construction waste management is done by Econ Pro (Recycling Contractor): 6048822733
 - The goal of this project is to reuse materials as much as possible. Waste Materials are separated onsite.

2. Is the amount of waste that is generated and recovered measured in your project? (*How much waste is generated? How much of it is recycled? What metrics do you use to assess the amount of waste generation (LSB per Sq.ft or dollar value of project)*)

Who is responsible for gathering that data? (*Is waste diversion measured by you (contractor), waste haulers, processors or waste transfer stations?*)

 - Econ Pro
 - Follow up with Ed Cepka → UBC project services has asked for the quantity of materials

3. How many separate bins you have on site to collect different types of waste?

Do you differentiate Construction and Demolition waste? Yes

Do you separate Reusable and recyclable materials? Yes

Do you separate different qualities of same material (eg. Wood, steel)? No

The only bin is for steel, the rest is separated in designated area on site (not enough space for bins)

Isolation

Drywall

Mixed garbage (dirt, excavated soil)

Cardboard → no charge

Conc → no charge for recycling

Asbestos (Bagged)

Plaster/cement

Wood (chipped and used as fuel)

Steel → money back

Copper

4. What types and how much of waste will be reused (in the same or different function), recycled, or sent to landfill?
 - Will be Reused: Wood, door/window frames, door handles (UBC like this type of door handles!), locks, Doors, Carpet tiles, Ceiling Tiles, bathroom tops, Insolation, Lighting fixtures (give out for free), soil (if be good for compacting), roller blinds, baseboards, white boards, ceiling steel T-bars (90% roughly), lights, pipes, electronic transformer, cable trays



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5. Is there any building code, requirements from transfer station or UBC Campus that you have to follow in regard to waste management?

The owner has asked the contractor to reuse materials as much as they can

6. What are the major obstacles to waste tracking for your company? (e.g. it costs, time requirement, or other factors)
Easy, just should be asked from recycling company (Econ Pro) → Usually do it for no charge to please the client (Mike has done another LEED project in Buchanan building with more than 90% recycling – 5 different bin)
7. How do you think UBC can help you in tracking and reporting the amount of waste (e.g., a web based tool)?

Clarify the requirement of tracking the waste in the contract

Waste Diversion:

8. Do you use the recovered waste in your own projects or sell them? What is the reason for your preference? (Costs, Quality or quantity of materials, customers, code requirements, storage requirement, time, etc.)

Yes. Owner's wanted to reuse

Demolition contractor is the owner of materials and can sell them to used building supply store

9. Does sending the waste to landfills or recovering it have different time/financial requirements or benefits for you? (Do you see any economic value in C&D waste recovery?)

- No economic benefit for the contractor, more ethical value for the society
- Reduces the cost and the bid as a result (beneficial for recycling and demolition contractors not for the construction contractor), less charge from transfer station
- No extra time or cost just motivation is needed. reuse is the requirement of the project

10. Who are your major customers for the recovered materials? (Get their contact if it is possible)

- Econ Pro takes care of it.
- Steel: AMIX (Ph: 1800-recycle)
- Rich Van: concrete

11. What are the key barriers to waste reduction and diverting in your projects? (e.g. lack of knowledge, cost, lack of infrastructure, time, storage space, customer, or other factors)

- Time consuming (Separating mixed materials: Taking off the nails from wood) → not worth it
- Not fit with new design
- Control the workers to throw the waste in the right bin
- Plastic and Styrofoam is difficult to recycle
- Enough room to setup bins

12. What are some opportunities to increase waste recovery? (What would need to happen for help you to achieve 75% or higher waste diversion?)

He claimed that they are already good

13. How could UBC help encourage reduction and diversion of waste? (e.g. on campus transfer station: not really necessary)

No idea!



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Contractor: Paul Davis
Date: 06/18/2013

Project: IK Barber Library

Waste Tracking:

1. How waste is typically collected on site, and where do different materials go for processing or disposal?

Designated employee for picking up garbage daily with a truck

Separate Bags, bring bins in, send them down, get to transfer station

2. Is the amount of waste that is generated and recovered measured in your project? (*How much waste is generated? How much of it is recycled? What metrics do you use to assess the amount of waste generation (LSB per Sq.ft or dollar value of project)*)

Who is responsible for gathering that data? (*Is waste diversion measured by you (contractor), waste haulers, processors or waste transfer stations?*)

Not generally. They only have rough idea about the amount.

Get weigh bills from transfer station of regional district

3. How many separate bins you have on site to collect different types of waste?

Do you differentiate Construction and Demolition waste?

No, they are treated in a same way.

Do you separate Reusable and recyclable materials?

Yes, metal ceiling, extra carpet tiles, lights, door hardware, electrical, light fixture, plumbing fixture, sinks: UBC takes it to reuse in future project → for other project outside UBC he mentioned that he tries to give good quality but not useful materials/products (door, glass, furniture: have economic value (each glass 400\$)) to anybody who wants them for free. Otherwise they will go to aggregate or chopped off.

Do you separate different qualities of same material (eg. Wood, steel)? **No**

Transfer station weigh truck each time it drops off a specific type of material

- Dry wall
- Steel: frame, elec conduit (Deconstructed not demolished) → Sometimes Reused
- Garbage
- Acoustical ceiling tiles (If not reusable should be bagged separately to be accepted at Transfer Stations) → Generally not reusable as it is soft and will be recycled → Large amount will be sent to specific points recycling companies (Name?)
- Carpet tile → Recycled in specific transfer station locations, worn out → not reused, Sometimes is mixed with general waste and be buried in station, or sent to companies that clean good shape but dirty tiles (If clients be interested, generally customers want new) (Name?)
- Conc (Small amount to regional district transfer stations, big amount which are in good shape and clean will be recycled by specific companies in north shore accept it with no cost
- Cardboard
- Plastic (regular garbage)
- Mixed garbage: waste, flooring, dust, etc
- Wood (not always separate)



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- Block/Brick
 - Florescent tubes
 - Light fixture (mixed garbage unless they have ballast)
 - Glass
4. What types and how much of waste will be reused (in the same or different function), recycled, or sent to landfill?
- Reused: door, glass, carpet tiles, ceiling tile
 - Recycled: steel, drywall, wood (On Campus less work with wood, mainly MDF, lumber → few amounts go into mixed garbage), carpet tiles, ceiling tile, brass and copper (get back money: electricians not renovation contractor), aluminum,
 - Landfill: mixed garbage
5. Is there any building code, requirements from transfer station or UBC Campus that you have to follow in regard to waste management?
- Transfer station regulation regarding separating the trash, Protocols regarding Asbestos (They test acoustic ceiling and if have asbestos should be bagged properly in specific bags and send to specific recyclers (closest is in Ontario) → separate contractor take care of it (Asbestos Abatement), take each type and standard amount to designated transfer stations
6. What are the major obstacles to waste tracking for your company? (e.g. it costs, time requirement, or other factors)
- Not difficult, but no need to do that, when it is not a LEED Project. They should just make sure that it does not exceed the max allowed amount, but they do not need to track the exact amount.
 - Some of them are not separated in small projects (wood goes into garbage, elect conduit goes into steel bin)
7. How do you think UBC can help you in tracking and reporting the amount of waste (e.g., a web based tool)?
- Contractors would just guess it except for the one that can be counted (e.g. lights), because it is too much work for nothing.
 - UBC should make it mandatory otherwise contactors just guess the amount.
 - (UBC can ask for weigh bills)

Waste Diversion:

8. Do you use the recovered waste in your own projects or sell them? What is the reason for your preference? (Costs, Quality or quantity of materials, customers, code requirements, storage requirement, time, etc.)
- Rarely
- Whatever is taken apart from building belongs to UBC
 - There is no money in recycling
 - Storage area is expensive
 - Sometimes it is against codes (old round door handles)
9. Does sending the waste to landfills or recovering it have different time/financial requirements or benefits for you?
- (Do you see any economic value in C&D waste recovery?)
- No, All the materials go to regional transfer station
10. Who are your major customers for the recovered materials? (Get their contact if it is possible)
- Follow-up to receive a list of them.



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11. What are the key barriers to waste reduction and diverting in your projects? (e.g. lack of knowledge, cost, lack of infrastructure, time, storage space, customer, or other factors)

- Separating everything is time consuming but it's more efficient
- Renovation projects generally happen when building and consequently materials (Specially carpet tiles) are old or worn out, outdated technology, does not meet the needs or expected efficiency
- For carpet tile if some be cleaned for reused but some be worn out, it is costly to order same style and they never match.
- Finding customer or someone who wants it
- Monitoring the workers to separate waste

12. What are some opportunities to increase waste recovery? (What would need to happen for help you to achieve 75% or higher waste diversion?)

People think that they don't have time for it: education, policing, charging and rules

Benefits:

- Reduce the amount of waste and consequently the cost
- Slow down filling of landfills
- Better to learn how to do it now than being forced in future

13. How could UBC help encourage reduction and diversion of waste? (e.g. on campus transfer station)

Not always possible → Define clear rules that contractors have to follow: people try to find shortcut

Contractor: Ledcore – Richard Arestad

Project: Ponderosa Commons

Date: 06/24/2013

Waste Tracking:

1. How waste is typically collected on site, and where do different materials go for processing or disposal?

- Waste is collected in disposal bins.
- The waste is then sent to the disposal facility for sorting.

2. Is the amount of waste that is generated and recovered measured in your project? (How much waste is generated? How much of it is recycled? What metrics do you use to assess the amount of waste generation (LSB per Sq.ft or dollar value of project))

Who is responsible for gathering that data? (Is waste diversion measured by you (contractor), waste haulers, processors or waste transfer stations?)

- Waste is measured in KG.
- We are targeting 97% diversion from landfill
- The waste haulers provide the data. They in turn receive this data from the recycling facilities.

3. How many separate bins you have on site to collect different types of waste? (Do you differentiate Construction and Demolition waste? Do you separate Reusable and recyclable materials?)

- 2 - 40 yard co-mingle waste bins
- 2 - 25/30 yard drywall bins
- 1 - 40 yard wood bin
- 1 - 30 yard cardboard bin
- 2 - 4 yard front tipper cardboard bins
- 1 - 20 yard metal bin



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- 1 - 10 yard concrete bin
 - 2 - 4 yard front tipper general waste bins
4. What types and how much of waste will be reused (in the same or different function), recycled, or sent to landfill?
- Recycled: Wood, drywall, cardboard, metal, concrete
 - Landfill: organics, plastics
5. Is there any building code, requirements from transfer station or UBC Campus that you have to follow in regard to waste management?
- n/a, other than LEED requirements.
6. What are the major obstacles to waste tracking for your company? (e.g. it costs, time requirement, or other factors)
- No major obstacles
7. How do you think UBC can help you in tracking and reporting the amount of waste (e.g., a web based tool)?

No need for the UBC support

Waste Diversion:

8. Do you use the recovered waste in your own projects or sell them? What is the reason for your preference? (Costs, Quality or quantity of materials, customers, code requirements, storage requirement, time, etc.)

Other than some instances of re-purposing existing materials from demolished buildings (eg. Old Ponderosa building) for the new building, the waste is typically not re-used in the same project.

9. Does sending the waste to landfills or recovering it have different time/financial requirements or benefits for you?

(Do you see any economic value in C&D waste recovery?)

Yes, there is economic value in waste recovery through reduced disposal fees.

10. Who are your major customers for the recovered materials? (Get their contact if it is possible)

- Ecowaste
- Urban Wood Waste

Waste haulers take the materials to these transfer stations and they distribute materials to the processing companies that buy recycled materials.

11. What are the key barriers to waste reduction and diverting in your projects? (e.g. lack of knowledge, cost, lack of infrastructure, time, storage space, customer, or other factors)

- Site space constraints
- Education of workers to ensure waste is placed in the correct bins
- Packaging (no use for plastic, foam, and ropes used in packaging)

12. What are some opportunities to increase waste recovery? (What would need to happen for help you to achieve 75% or higher waste diversion?)

- It shouldn't be difficult to achieve 90% or higher waste diversion.



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- Opportunities for the remaining 10% include:
 - UBC extending organic compost collection to construction sites.
 - Companies to reduce plastic content, and packaging.

13. How could UBC help encourage reduction and diversion of waste? (e.g. on campus transfer station)

- UBC extending organic compost collection to construction sites.
- Facility to address items that typically are not recycled on a construction site (i.e. plastics, etc.)
- Connecting the contractors with recycling companies that have high diversion rates
- Providing an online list of recycling companies that contractors can work with

Contractor: El Shaddai – Mike Briant

Date: 06/25/2013

Project: Geography Building

(Seismic exterior renovation)

Waste Tracking:

1. How waste is typically collected on site, and where do different materials go for processing or disposal?
 - Gathered in separate piles, load on trucks (everyday) and sent to transfer station
2. Is the amount of waste that is generated and recovered measured in your project? (How much waste is generated? How much of it is recycled? What metrics do you use to assess the amount of waste generation (LSB per Sq.ft or dollar value of project))

Who is responsible for gathering that data? (Is waste diversion measured by you (contractor), waste haulers, processors or waste transfer stations?)

80 % is roughly recycled (his guess)

3. How many separate bins you have on site to collect different types of waste? (Do you differentiate Construction and Demolition waste? No. Do you separate Reusable and recyclable materials? No.)

Only one bin can come at a time. Piles of separate materials

- Wood: recyclable (mainly for compost: he guess) (30 yard bin/ qfeet)
- Shrubbery/trees: compost
- Insulation (no insulation in this project)
- Drywall (more than half tone: abatement crew)
- Asbestos: abatement crew (anything might have asbestos can't be recycled: e.g.: Library floor tiles)
- Soil
- steel (steam pipe, plumbing / pipe: around half tone) → scrap
- aluminum/copper (not that much)
- Plumbing piping (1/4 tone)
- Elect conduit (less than 50 ponds → in scrap steel pile)
- Flooring (3 half tone loads)
- Mixed garbage

4. What types and how much of waste will be reused (in the same or different function), recycled, or sent to landfill?

- Recycled: Wood, drywall, cardboard, metal, concrete
- Landfill: organics, plastics

5. Is there any building code, requirements from transfer station or UBC Campus that you have to follow in regard to waste management?



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- Not mixing all waste → waste is a green space and construction practice and transfer station requirement

6. What are the major obstacles to waste tracking for your company? (e.g. it costs, time requirement, or other factors)

- No major obstacles → counting the bins and size → pick-up truck

7. How do you think UBC can help you in tracking and reporting the amount of waste (e.g., a web based tool)?

Garbage bags make it difficult to know what's in it and can result in wrong classification or separating materials that are mixed by mistake (→ myself: maybe transparent containers!)

- Sometimes garbage cans are used and then will be emptied in bins (garbage can be seen in it) → no requirement for cleaning afterward

Waste Diversion:

8. Do you use the recovered waste in your own projects or sell them? What is the reason for your preference? (Costs, Quality or quantity of materials, customers, code requirements, storage requirement, time, etc.)

- Floor joist (high quality as it is old)
- Structural members → wood
- Piping
- Electrical

9. Does sending the waste to landfills or recovering it have different time/financial requirements or benefits for you?

(Do you see any economic value in C&D waste recovery?)

- Contributing to environment
- Composting worth money, but we don't get much money
- If you bring mixed waste they make you sort it, only metal is free

10. Who are your major customers for the recovered materials? (Get their contact if it is possible)

- No specific reclamation company that we work with

11. What are the key barriers to waste reduction and diverting in your projects? (e.g. lack of knowledge, cost, lack of infrastructure, time, storage space, customer, or other factors)

- Site space constraints (separate bins can't be set up: only 2 at a time)
- Waste bags (can't be seen)
- Small mixed materials

12. What are some opportunities to increase waste recovery? (What would need to happen for help you to achieve 75% or higher waste diversion?)

- Don't waste the remaining of material that is utilized in construction (e.g. beam: utilize the extra remaining part)

13. How could UBC help encourage reduction and diversion of waste? (e.g. on campus transfer station)

- UBC keep require contractors to think green



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Contractor: turn-Key – Brian Adamson
Date: 06/26/2013

Project: FNH Labs

Waste Tracking:

1. How waste is typically collected on site, and where do different materials go for processing or disposal?
 - Gathered in separate piles, load on one bin that is downstairs in entrances (not enough space for separate bins), demo company take care of waste: 3R Demo
2. Is the amount of waste that is generated and recovered measured in your project? (*How much waste is generated? How much of it is recycled? What metrics do you use to assess the amount of waste generation (LSB per Sq.ft or dollar value of project)*)

Who is responsible for gathering that data? (*Is waste diversion measured by you (contractor), waste haulers, processors or waste transfer stations?*)

 - demo company take care of waste: 3R Demo → they get receipt of amount of waste and diversion rates
3. How many separate bins you have on site to collect different types of waste? (Do you differentiate Construction and Demolition waste? No. Do you separate Reusable and recyclable materials? No.)

Only one bin can come at a time.

 - Wood
 - Drywall
 - Cardboard
 - steel
 - Mixed garbage
4. What types and how much of waste will be reused (in the same or different function), recycled, or sent to landfill?
 - No reused rate
 - Separated waste goes to transfer station and they take care of it
 - Mixed garbage, mixed products (countertop: takes long to separate it)
5. Is there any building code, requirements from transfer station or UBC Campus that you have to follow in regard to waste management?
 - UBC encourage to recycle → Project services ask us waste/recycling quantities
 - Hazardous, Asbestos → abatement company
6. What are the major obstacles to waste tracking for your company? (*e.g. it costs, time requirement, or other factors*)
 - Money (recycling cost money) No body buys used material we should give them for free to others
 - Time
7. How do you think UBC can help you in tracking and reporting the amount of waste (*e.g., a web based tool*)?
 - Easier access and machines to site



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Waste Diversion:

8. Do you use the recovered waste in your own projects or sell them? What is the reason for your preference? (*Costs, Quality or quantity of materials, customers, code requirements, storage requirement, time, etc.*)

No

9. Does sending the waste to landfills or recovering it have different time/financial requirements or benefits for you? (*Do you see any economic value in C&D waste recovery?*)

The money that comes out of recycling goes to recycling company. In smaller projects that they take care of waste they might get few money for scrap metal

10. Who are your major customers for the recovered materials? (*Get their contact if it is possible*)

No specific customer

- New west

11. What are the key barriers to waste reduction and diverting in your projects? (*e.g. lack of knowledge, cost, lack of infrastructure, time, storage space, customer, or other factors*)

- Time consuming to take apart components, take out screws and nails, have them in exact required size and length

12. What are some opportunities to increase waste recovery? (*What would need to happen for help you to achieve 75% or higher waste diversion?*)

- Allocate money to recycling. Make it required

13. How could UBC help encourage reduction and diversion of waste? (*e.g. on campus transfer station*)

- Monetary incentives
- Easy access

Contractor: Division 15 – Patrick Osada
Date: 07/02/2013

Project: Place Vanier Residence – Pipes

Waste Tracking:

1. How waste is typically collected on site, and where do different materials go for processing or disposal?

- Not so much waste to deal with. All collected in garbage bags and go to one commingle bin located in south campus and when it's full they call the disposal company to pick up the bin. Super Save (the disposal company) sort out the mixed waste to some extent.

2. Is the amount of waste that is generated and recovered measured in your project? (*How much waste is generated? How much of it is recycled? What metrics do you use to assess the amount of waste generation (LSB per Sq.ft or dollar value of project)*)

Who is responsible for gathering that data? (*Is waste diversion measured by you (contractor), waste haulers, processors or waste transfer stations?*)

- Not mandated to assess the amount of waste in the contract, but is very minimal (in 3 month that they have been here they have not filled one bin (8 cubic yard: 5ft*5ft*8ft) yet.



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3. How many separate bins you have on site to collect different types of waste? (Do you differentiate Construction and Demolition waste? No. Do you separate Reusable and recyclable materials? No.
Only one commingle waste bin → short pieces of pipe
4. What types and how much of waste will be reused (in the same or different function), recycled, or sent to landfill?
 - Small pieces of pipe would be reused if it can fit in the needed place
5. Is there any building code, requirements from transfer station or UBC Campus that you have to follow in regard to waste management?
No → Disposal company is responsible with transfer station requirements
6. What are the major obstacles to waste tracking for your company? (e.g. it costs, time requirement, or other factors)
No obstacles → easy to track: the number of dumping the bin and its size makes it possible to track waste
7. How do you think UBC can help you in tracking and reporting the amount of waste (e.g., a web based tool)?
No need for help

Waste Diversion:

8. Do you use the recovered waste in your own projects or sell them? What is the reason for your preference? (Costs, Quality or quantity of materials, customers, code requirements, storage requirement, time, etc.)
 - Yes. Every piece of pipe over 3 feet long is kept to be reused in other place in project to make a corner, etc.
 - They have 2 huge sorting sites on campus, so it is lots of room to keep remaining pipe pieces
9. Does sending the waste to landfills or recovering it have different time/financial requirements or benefits for you? (Do you see any economic value in C&D waste recovery?)
 - No
10. Who are your major customers for the recovered materials? (Get their contact if it is possible)
 - All the pipes (steel pre insulated pipe) and fittings used in the project, which come from Denmark, are owned by UBC project services. Crop pipes go back to UBC storage site.
11. What are the key barriers to waste reduction and diverting in your projects? (e.g. lack of knowledge, cost, lack of infrastructure, time, storage space, customer, or other factors)
 - Bonded piping system makes separating the materials difficult → expensive and time consuming
 - Food waste
 - Waste is minimal (the amount of required materials in each phase is assessed by engineers so there is not many excess) and does not worth separating
12. What are some opportunities to increase waste recovery? (What would need to happen for help you to achieve 75% or higher waste diversion?)
 - We are mechanical contractor and do not have much waste → finding a way to separate bonded materials
13. How could UBC help encourage reduction and diversion of waste? (e.g. on campus transfer station)
 - If they can come with an idea of separating polyurethane insulation from steel pipe



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10/23/2013

Contractor: Flynn Roofing – Blane Braun

Project: Re-roofing of MacMillan Building

Date: 07/09/2013

Waste Tracking:

1. How waste is typically collected on site, and where do different materials go for processing or disposal?
(Replacing the old mopped on system will be replaced with torch on system → New insulation, skylight, metal roof cladding over skylight)
 - Huge vacuum for ballast (rock and dust) on top of old roof → into the truck and be taken for disposal
 - Bins on site → materials will be craned from the roof into bins
 - Demo contractor (Quantum Murray) for demolition and getting rid of demo materials → Hazardous materials and asbestos
 - Construction excess will be handled by themselves in another bin → Mini Load (subcontractor for waste disposal) supply bin and also dispose it will take it to landfill or recycling locations to be disposed properly
2. Is the amount of waste that is generated and recovered measured in your project? (*How much waste is generated? How much of it is recycled? What metrics do you use to assess the amount of waste generation (LSB per Sq.ft or dollar value of project)*)
Who is responsible for gathering that data? (Is waste diversion measured by you (contractor), waste haulers, processors or waste transfer stations?)
 - Not measured. They pay per bin load. Around 11 bins for roof demo and 1-2 bins for construction (40 yds bin)
 - At the end they know how many bins are filled but they don't keep track of it. (they get waybills)
James from project management will give them the form to fill
3. How many separate bins you have on site to collect different types of waste? (Do you differentiate Construction and Demolition waste? Yes. Do you separate Reusable and recyclable materials? No.)
 - Only two bins (Demo and construction) Concrete will be loaded separately. →
 - Demolition: Pollyiso, Roofing membrane, scrap metal (all mixed)
 - Construction: adhesive primer, empty buckets, foam container adhesive, used rollers, cut strips of membrane and pollyiso and wood
4. What types and how much of waste will be reused (in the same or different function), recycled, or sent to landfill?
 - All go to waste management places and landfill
5. Is there any building code, requirements from transfer station or UBC Campus that you have to follow in regard to waste management?
 - Only gypsum and drywall is mandated to be separate
 - Asbestos should be treated separated
But anything else can be mixed
6. What are the major obstacles to waste tracking for your company? (*e.g. it costs, time requirement, or other factors*)
 - As we are not separating waste right now, there is no benefit in changing this practice and follow waste unless it is required
 - Time and cost (charge more to follow waste)
7. How do you think UBC can help you in tracking and reporting the amount of waste (*e.g., a web based tool*)?
Providing the form and requiring filling it



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Waste Diversion:

8. Do you use the recovered waste in your own projects or sell them? What is the reason for your preference? (*Costs, Quality or quantity of materials, customers, code requirements, storage requirement, time, etc.*)

No. Old roof materials can't be reused. They are already failed → Rock may be reused

9. Does sending the waste to landfills or recovering it have different time/financial requirements or benefits for you?

(*Do you see any economic value in C&D waste recovery?*)

- Metal has benefit
- Other materials have no benefit
- Waste of time and money separating materials → separate shoots and bins for each type

10. Who are your major customers for the recovered materials? (*Get their contact if it is possible*)

- Not aware of.

11. What are the key barriers to waste reduction and diverting in your projects? (*e.g. lack of knowledge, cost, lack of infrastructure, time, storage space, customer, or other factors*)

Time and cost of time

12. What are some opportunities to increase waste recovery? (*What would need to happen for help you to achieve 75% or higher waste diversion?*)

- Not in roofing product → old products are contaminated
- Maybe in future current materials can be diverted more easily but he is not sure (Myself: UBC should make sure of reusability and recyclability of new materials)

13. How could UBC help encourage reduction and diversion of waste? (*e.g. on campus transfer station*)

- As we are concerned about cost of excess waste we are already trying to minimize it

Contractor: VPAC Construction – Pdraig Lyng
Date: 08/07/2013

Project: Buchanan B Rms 202, 204, 206
Merging 3 rooms

Waste Tracking:

1. How waste is typically collected on site, and where do different materials go for processing or disposal?

- In demo stage: Everything is separated in piles: Drywall, insulation, steel stud, concrete → taken to separate recycling places
- In Construction stage: Bits of waste all over the room → after finishing put them in separate piles → taken to separate recycling

Try to separate even the small amounts: Drywall is not accepted and has to be separated, metal (prefer separated) → Only pure waste is remained

One truck carries them all in bags or in different piles: waste, drywall (limited to one 4*4 sheet in the City dump so they take drywalls to Recycling places), metal (conduit, steel stud)

They have a demo contractor but they haul the construction waste themselves

2. Is the amount of waste that is generated and recovered measured in your project? (*How much waste is generated? How much of it is recycled? What metrics do you use to assess the amount of waste generation (LSB per Sq.ft or dollar value of project)*)



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Who is responsible for gathering that data? (*Is waste diversion measured by you (contractor), waste haulers, processors or waste transfer stations?*)

Only in demo stage as they have to pay Demo Company based on weight

They assess the amount beforehand and receive the waybills with invoice

3. How many separate bins you have on site to collect different types of waste? (Do you differentiate Construction and Demolition waste? Yes they will happen in diff stages. Do you separate Reusable and recyclable materials? Rarely, If they can find a use for it in their project (e.g. steel stud))

In small projects only three-four bins: Metal, drywall, insulation, garbage

4. What types and how much of waste will be reused (in the same or different function), recycled, or sent to landfill?

- Depend on: how old the material is (e.g. insulation), how the material comes out (e.g. steel stud)
- In a bigger projects there are more possibilities (e.g. Crushing conc)

5. Is there any building code, requirements from transfer station or UBC Campus that you have to follow in regard to waste management?

- No real limitation from the City apart from hazardous materials
- The dump limitation: metal and drywall limitation
- UBC preferred us to achieve 100% recycling rate (not mandatory)

6. What are the major obstacles to waste tracking for your company? (*e.g. it costs, time requirement, or other factors*)

- Not difficult specially in small project: easy to assess and track

7. How do you think UBC can help you in tracking and reporting the amount of waste (*e.g., a web based tool*)?

Not that I can think of.

Waste Diversion:

8. Do you use the recovered waste in your own projects or sell them? What is the reason for your preference? (*Costs, Quality or quantity of materials, customers, code requirements, storage requirement, time, etc.*)

Steel stud, new and good quality insulation

9. Does sending the waste to landfills or recovering it have different time/financial requirements or benefits for you?

(*Do you see any economic value in C&D waste recovery?*)

Economically beneficial in reuse: prevent from buying new

A little time constrained to separate and clean them, but this extra time usually does not cost more than buying new

Small amounts doesn't make much economic differences, in big project recycling is beneficial

Not even very beneficial for demo companies as they will pay for most of waste except for metal, steel, copper

10. Who are your major customers for the recovered materials? (*Get their contact if it is possible*)

- Take each type of waste to its specific recycling factory and pay to take it from them

11. What are the key barriers to waste reduction and diverting in your projects? (*e.g. lack of knowledge, cost, lack of infrastructure, time, storage space, customer, or other factors*)



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- Keeping waste separate
- In larger projects during construction stage get workers to use the separate bins (wood, metal, cardboard)
- Find a recycling company for each type
- Time to separate specially in larger demo
- Storage area

12. What are some opportunities to increase waste recovery? (*What would need to happen for help you to achieve 75% or higher waste diversion?*)

- During construction: make sure separate bins are set up and make sure all people are aware of them and use them correctly.

13. How could UBC help encourage reduction and diversion of waste? (*e.g. on campus transfer station*)

- Having online program to input data into
- Setting requirement to manage waste and recycle. After some time of forcing the best practice, contractors see it work out this way, they will start doing that off-campus.
- Normal practice in Europe is much better than North America, because ppl are more used to it.



Appendix 2: Demolition Sub-contractors Interviews

Contractor: Lorn Penton - East to West Demo
Date: 19/07/13

Project: Food and Nutrition Building Lecture theater – Room 60

Waste Tracking:

- How waste is typically collected on site, and where do different materials go for processing or disposal?
 - Separate waste as we go since 4-5 years ago –
 - Even for they mixed waste (small projects), they try to keep them separate so that it can be separated in yards easily.
 - If take mixed waste in inner city recycling at Richmond yard (private yards) they sort it (hand picking) and it result in a small amount of extra charge (separate around 60\$ / ton. Mixed 90\$ / ton vs. adding a separate bin and truck about 300\$) → Even small amount of mixed waste, which does not worth separating, will be separated and recycled.
 - Governmental facilities don't separate (Wastec). They only charge more for mixed waste.
 - In long run separating waste will cost more → increases the number of trucks
- Is the amount of waste that is generated and recovered measured in your projects? (*How much waste is generated? How much of it is recycled? What metrics do you use to assess the amount of waste generation (LSB per Sq.ft or dollar value of project)*)

Who is responsible for gathering that data? (*Is waste diversion measured by you (contractor), waste haulers, processors or waste transfer stations?*)

Their company keeps the waybills (amount of waste and recycling percent) that they receive from yards, to track waste in case the contractor requires it.

They worked with UBC contractors, and offered them to give them the receipts, but they said it's not required for them.

- How many separate bins you have on site to collect different types of waste?

Do you differentiate Construction and Demolition waste? They don't deal with construction waste yet.

Do you separate Reusable and recyclable materials? No, they don't find someone who wants it quickly. Sometime give them for free)

Depend on size of project.

 - Wood (cheaper dump) → laminated wood only can be used as fuel
 - Metal (paid back)
 - Drywall (won't be accepted mixed) → expensive to dump both separate and mixed
 - Garbage (non-recyclable)
 - Cardboard is not accepted in mixed waste but they don't have a separate bin for it. Just keep separated
- What are the major obstacles to waste tracking for your company? (*e.g. it costs, time requirement, or other factors*)
 - Tracking waste has no considerable extra cost
 - Not enough room to set up bins and park on campus so they have to carry out each type of material separately with truck and trailer (one day metal, next day cardboard, so on) → although separate bins cost less that separate trucking they are not allowed to have bins on campus
 - Mixed waste cannot be recycled → take time



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5. Is there any building code, requirements from transfer station or UBC Campus that you have to follow in regard to waste management? (*For separating, recovering, etc.*)

What types of mixed waste materials won't be accepted in transfer stations and landfills?

- Many companies require separating and diverting waste.
- Cardboard and drywall → drywall requires asbestos check
- Unless customers require to divert waste.

6. How do you think UBC can help you in tracking and reporting the amount of waste (*e.g., a web based tool*)?

Ask for the receipt

Waste Diversion:

7. What types and how much of waste will be reused (in the same or different function), recycled, or sent to landfill?

- In normal project at least 80% can be recycled
- Maybe 10% of materials are reusable (doors, counters, etc)

8. Do you gain money recovering waste? Does it worth your time? Who are your major customers for the recovered materials?

- Only metal, cardboard (not worth the time and energy)
- Allied salvage for metal
- They will charge the contractors about 5% more for separating waste because of more bins and trucking

9. Where do you separate the waste (*on-site, in transfer stations, in landfills, etc*)?

Separate waste in piles carried with separate trucks

10. Do you have any system for separating small quantities of waste? (*Special bins, transferring waste of more than one project to landfills, etc.*)

Small blue bins, keep them at garage (home) until there is enough of a type to fill a truck
There is no truck that can carry small amount of waste in separate piles

11. Can packaging and plastic be recycled?

Only hard plastic can be recycled

Plastic and Styrofoam is not recycled

12. What are the key barriers to waste reduction and diverting in your projects? (*e.g. lack of knowledge, cost, lack of infrastructure, time, storage space, customer, or other factors*)

Unrecyclable materials (glass, plastic, isolation, flooring)

Governmental yards don't care about separating waste. Small mixed waste is better to be separated by yard workers



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13. What are some opportunities to increase waste recovery in small projects? (*What would need to happen for help you to achieve 75% or higher waste diversion?*)

- People are more concerned and conscious about waste
- Anything that is recyclable material is recycled, the problem is not recyclables
- Some contractors are not interested in increasing the price (even small amount) for separating waste

14. How could UBC help encourage reduction and diversion of waste? (*e.g. on campus transfer station*)

- Make delivering the forms and receipt mandatory
- Provide space
- Educate workers to know what can be recycled

Contractor: Kaj Brisko - Devastate/Div 2 contracting

Project: UBC Sauder School of Business

Date: 31/07/13

Waste Tracking:

1. How waste is typically collected on site, and where do different materials go for processing or disposal?

In Sauder school:

- Shoot from different levels of the building, two bins at the site which were swap of 2-4 times a day
- 2-3 bins a day would be carried to the transfer stage
- Depending on the size of the project and the site

2. Is the amount of waste that is generated and recovered measured in your projects? (*How much waste is generated? How much of it is recycled? What metrics do you use to assess the amount of waste generation (LSB per Sq.ft or dollar value of project)*)

Who is responsible for gathering that data? (*Is waste diversion measured by you (contractor), waste haulers, processors or waste transfer stations?*)

- They have dedicated employee to track waste and keep the records (Kaj Brisko)

3. How many separate bins you have on site to collect different types of waste?

Do you differentiate Construction and Demolition waste? Only responsible for the demo stage.

Do you separate Reusable and recyclable materials? No materials were not reused on site. Unless they were asked to keep any of materials for reuse (very small items like doors). Metal and wood could be recycled, but 100% recycled)

40 yards bins: wood, metal, concrete, drywall, garbage

(sometime wood, cardboard, and drywall will be mixed in garbage but at the end the will be separated and then are taken to the dumps)

4. What are the major obstacles to waste tracking for your company? (*e.g. it costs, time requirement, or other factors*)

- Easy if the company dedicates an employee to track.
- Has not gotten enough foothold in our industry yet
- Pure garbage loads are difficult to break out to recyclable and non recyclable
- If the dump don't weigh scale and way tickets (They place that they dump concrete does not have scale and they assess just by experience and eyeballing)
- Weigh scale at dumps will let you know the exact amount of waste and recycling percentage



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(Zahra: we should make sure that contractors work with dumps that have scale and issue bills)

5. Is there any building code, requirements from transfer station or UBC Campus that you have to follow in regard to waste management? *(For separating, recovering, etc.)*

No requirements

LEED: Maximum the recyclable amount, but they are more concerned about accounting the amount of waste

6. What types of mixed waste materials won't be accepted in transfer stations and landfills?

7. How do you think UBC can help you in tracking and reporting the amount of waste *(e.g., a web based tool)*?

UBC should demand tracking and submitting the reports as a part of the project (have a general requirement in the contract for general contractor or subcontractor) and fine them. And ask for receipt in a monthly base.

Waste Diversion:

8. What types and how much of waste will be reused (in the same or different function), recycled, or sent to landfill?

Reuse happens but it is very minimalistic and the contractor might request keeping some materials if possible but will not force it.

Pavers (stone) are reusable

9. Do you gain money recovering waste?

Metal can be profitable. Recycling concrete reduce the dump load (100% recyclable). Garbage that has drywall or wood (it is cheaper to dump it as wood than garbage) has to separated (extra time& cost

Does it worth your time?

It does not cost much more for contractors as the demolition company save money by reducing the amount of waste that has to take to dump as a replacement for extra time for deconstructing

Who are your major customers for the recovered materials?

Mitchel Island Material (Concrete), Richmod Steel, shnitzer steel

- Are chosen based on the offering price and the ease of the process
- The City and Metro Van dump are a lot more stringent in policy (mixed waste and accounting) and also more expensive
- Having separate bins is more profitable in the longrun.

10. Where do you separate the waste *(on-site, in transfer stations, in landfills, etc)*?

The small amounts will be mixed and transfer station employees separate them, but the number of employees are not enough for the massive loads of mixed waste. Big amounts will be separated on-site.

11. Do you have any system for separating small quantities of waste? *(Special bins, transferring waste of more than one project to landfills, etc.)*



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Every transfer station has employees who sift through waste and separate as much as possible for recycling

12. Can packaging and plastic be recycled?

No, they go to garbage

13. What are the key barriers to waste reduction and diverting in your projects? (e.g. lack of knowledge, cost, lack of infrastructure, time, storage space, customer, or other factors)

- Money (its more economical to dump all the waste rather than separate waste)
- Space limitations
- Time constraints
- Ease of the process
- Because of the bidding process they cannot increase the cost to recycle more

14. What are some opportunities to increase waste recovery in small projects? (What would need to happen for help you to achieve 75% or higher waste diversion?)

- Account for waste
- Knowing the proper place to deal with each type of material

15. How could UBC help encourage reduction and diversion of waste? (e.g. on campus transfer station)

- Enforce waste management and recycling in contract for not LEED projects
- Working with one sub-contractor to deal with waste in a number of small projects

Contractor: Ray Grendus - Fraser Trucking & Tractor Ltd.

Project: --

Date: 01/08/13

Waste Tracking:

1. How waste is typically collected on site, and where do different materials go for processing or disposal?

It is collected and separated by hand onsite and depending on the type of materials they will be sent to the related recycling facility (metal, dry wall, concrete, wood: urban wood waste: they sort the wood based on the quality (clean wood, etc) so that they get better price on recycling end)

2. Is the amount of waste that is generated and recovered measured in your projects? (How much waste is generated? How much of it is recycled? What metrics do you use to assess the amount of waste generation (LSB per Sq.ft or dollar value of project))

Who is responsible for gathering that data? (Is waste diversion measured by you (contractor), waste haulers, processors or waste transfer stations?)

They estimate the amount of waste by seeing the place. Then it will be confirmed with scale ticket (They only collect it for their own use for having more accurate bidding), but the customer don't ask for it except for LEED jobs.

3. How many separate bins you have on site to collect different types of waste?

Do you differentiate Construction and Demolition waste? They only deal with demolition

Do you separate Reusable and recyclable materials?

Depending on the project, the steps and the order are different.



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As there is not usually enough room for separate bins, and they usually have one bin. So they usually follow the following steps (minimize the cost and maximize the amount of material that goes into a load in each hauling):

1. Pull out ceiling tiles → keep in the bin. If they are wooden, will be sent to Urban Waste Wood
2. Ceiling T-bars → If they are enough for a bin will be kept in bin otherwise will be stacked on-site until the load is enough to fill a bin
3. Drywall
4. Framing for the T-bars and walls

The bin will be loaded by each type of material that they are dealing with at the moment; it will be hauled and then in will be loaded with something else.

4. What are the major obstacles to waste tracking for your company? (e.g. it costs, time requirement, or other factors)
 - No obstacle (They know the exact amount and cost)
5. Is there any building code, requirements from transfer station or UBC Campus that you have to follow in regard to waste management? (For separating, recovering, etc.)
 - Legal disposal in licensed facility
6. What types of mixed waste materials won't be accepted in transfer stations and landfills?

7. How do you think UBC can help you in tracking and reporting the amount of waste (e.g., a web based tool)?
 - Make sure that contractors are licensed
 - Make sure that contractors hire a subcontractor that does a better job in recycling if it increases the bidding cost
 - Mandate submitting waybills

Waste Diversion:

8. What types and how much of waste will be reused (in the same or different function), recycled, or sent to landfill?
 - Reuse: Cabinet (if it is in good shape), doors (if it is stated in drawings notes – labor cost for removing a door 35\$ vs. 10\$ new door), plumbing fixtures
 - Recycle: steel
 - Recycling rate is generally 90%

9. Do you gain money recovering waste?

It offsets the costs. They do not mixed any type of waste for the cost (Clean wood: 25\$/ton vs. mixed load wood 95\$/ton) Most of the time sorting the waste as it comes down cost the same a mixing them.

Does it worth your time? It worth saving the environment

Who are your major customers for the recovered materials? ---

The higher volume of haul each month the charge become less (VIP price)

They will send each type of waste to the related recycling facility



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10. Where do you separate the waste (*on-site, in transfer stations, in landfills, etc*)?

90% On site. Small amounts will go to transfer station.

11. Do you have any system for separating small quantities of waste? (*Special bins, transferring waste of more than one project to landfills, etc.*)

Sort onsite in smaller containers or will be sent mixed to transfer station to be separated: Hauling cost vs. mixed load cost

12. Can packaging and plastic be recycled?

Paper and cardboard are recycled but not plastic

13. What are the key barriers to waste reduction and diverting in your projects? (*e.g. lack of knowledge, cost, lack of infrastructure, time, storage space, customer, or other factors*)

No barriers, we know how to approach the projects

- BC Building code does not allow reusing lumber as structural material → Salvaging in BC has become worst since 15-20 years → market has a high interest in new
- There is no market for reusable materials even if they are not old

14. What are some opportunities to increase waste recovery in small projects? (*What would need to happen for help you to achieve 75% or higher waste diversion?*)

- The loads of small pieces and swiping waste (10%) → if be sent to transfer station, they will try a secondary sort
- They are involved with Metro Vancouver in changing the criteria of Vancouver landfills. They will go down from 5% allowed wood waste to 3%, which will affect the demolition method. → raise the cost considerably (e.g. two bedroom demo costs 10000\$, but it will be 30000\$)
- Change the BC codes to reuse lumber as structure instead of recycle (Currently they are shipped outside of Canada)
- Recycling create job opportunity and improve local economy

15. How could UBC help encourage reduction and diversion of waste? (*e.g. on campus transfer station*)

Mandate specific recycling percentage, separating onsite

On-campus transfer station does not work as it increases the cost

Zahra: Work with private transfer stations as they are in the business and care about earning money (Make sure they recycle the amount that they state)



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Contractor: Dano Debney - Aerostars Contracting Ltd
Date: 15/08/13

Project: Geography Building

Waste Tracking:

1. How waste is typically collected on site, and where do different materials go for processing or disposal?
Separate everything; try to sell them as much as possible to the public or specific recycling stations

2. Is the amount of waste that is generated and recovered measured in your projects? (*How much waste is generated? How much of it is recycled? What metrics do you use to assess the amount of waste generation (LSB per Sq.ft or dollar value of project)*)
Who is responsible for gathering that data? (*Is waste diversion measured by you (contractor), waste haulers, processors or waste transfer stations?*)
 - Only for LEED jobs
 - 70% waste diversion except for drywall

3. How many separate bins you have on site to collect different types of waste?
Do you differentiate Construction and Demolition waste?
They only deal with demolition
Do you separate Reusable and recyclable materials?
Drywall, wood, precious metals, glass (not necessarily bins, they are separated in piles)

4. What are the major obstacles to waste tracking for your company? (*e.g. it costs, time requirement, or other factors*)
Tracking is Not required
 - Pricing is tight (They will not win the bidding if they raise the price for tracking or recycling)

5. Is there any building code, requirements from transfer station or UBC Campus that you have to follow in regard to waste management? (*For separating, recovering, etc.*)
Transfer station demand separating materials, less for wood

6. What types of mixed waste materials won't be accepted in transfer stations and landfills?

7. How do you think UBC can help you in tracking and reporting the amount of waste (*e.g., a web based tool*)?
Restriction (And checking the accuracy so that they cannot manipulate the information) → having the transfer station to make sure the data is correct → for not LEEDs

Waste Diversion:

8. What types and how much of waste will be reused (in the same or different function), recycled, or sent to landfill?
 - Recycle: Valuable metal (e.g. copper, tin), clean non-reusable wood (personal use as fuel), concrete



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- Reuse: Tin cladding and roofing sold for shed, lumber (to be reused as furniture as antique wood): 2*4, 2*6, joist, plywood, doors, windows, mirror toilets, insulation (is sold for garage and sheds: more request than supply) → reduce the dump cost, one of the double bags to pack it (it is mandated by transfer station, time, etc.)
 - Drywall (Is used to kill algae in the ocean)
9. Do you gain money recovering waste?
- It offsets the costs of dismantling or dumping. Does it worth your time? Not very profitable that worth the time
- Who are your major customers for the recovered materials?
- Craigslist, Depending on the quality: sell or give for free
10. Where do you separate the waste (*on-site, in transfer stations, in landfills, etc*)?
- Separate onsite by planning the demolition steps: 1. Ceiling, 2. Walls 3. floors
11. Do you have any system for separating small quantities of waste? (*Special bins, transferring waste of more than one project to landfills, etc.*)
- Layering the stacks of different types of materials (big pieces) in one truck load or use garbage can for small pieces (The material can be seen in the can)
 - Not really using bins as it is difficult to separate waste in it. Separating different types in trailer truck
 - Separating screws with magnet, keeping them in their shop until it reaches enough quantity to sell
12. Can packaging and plastic be recycled?
- Some recycling places take plastic
13. What are the key barriers to waste reduction and diverting in your projects? (*e.g. lack of knowledge, cost, lack of infrastructure, time, storage space, customer, or other factors*)
- Some companies send the whole load to the US so that they don't have to separate waste
 - Time
 - Space for keeping waste until it fills a load
14. What are some opportunities to increase waste recovery in small projects? (*What would need to happen for help you to achieve 75% or higher waste diversion?*)
- Have a storage area for waste until it reaches enough quantity to fill a truck (transfer station)
 - More strict regulations
15. How could UBC help encourage reduction and diversion of waste? (*e.g. on campus transfer station*)
- Having a close transfer station or provide the bins and check the proper use of it.
 - Force recycling



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Zahra Hosseini
10/23/2013

Appendix 3: List of Interviewees

Name	Company	Phone	Project	Email
General Contractors				
Brendan Reid	Holaco Const		CEME Lab Renovation	
Blane Braun	Flynn Roofing Canada		MacMillan Building roofing	
Jas Singh	El Shaddai Construction & Management LTD.		Geography Building	
Paul Davies	Aberdane		Ike Barber 255/310	
Mike Fisher	Scott Special Projects		University Centre	
Brian Adamson	Turn-Key		FNH 2nd Floor N. Wing Labs	
Patrick Osada	Division 15		Place Vanier Residence	
Richard Aarestad	Ledcor Construction		Ponderosa Commons	
Padraig Lyng	VPAC Construction		Buchanan B Rooms 202, 204, 206	
Demolition Sub-Contractors				
Lorn Penton	East to West Demo			
Ray Grendus	Fraser Trucking & Tractor Ltd.			
Dano Debney	Aerostars Contracting Ltd		Geography Building	
Kaj Brisko	Div 2 contracting		Sauder Business School, Phase III	



Appendix 4: Projects Pictures



Figure 1 Door knob and door handle stored onsite for reuse in other UBC projects, The contractor mentioned that UBC favors keeping these door handles, **Project:** University Centre - **Contractor:** Scott Special Projects



Figure 2 Ceiling tiles stored on-site to be reused in the same project, **Project:** University Centre - **Contractor:** Scott Special Projects



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Figure 3 Carpet tiles stored on-site to be reused in the same project, **Project:** University Centre - **Contractor:** Scott Special Projects



Figure 4 Pipes and air ducts stored on-site to be reused in the same project, **Project:** University Centre - **Contractor:** Scott Special Projects



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Figure 5 Pipes stored on-site to be reused in the same project, **Project:** University Centre - **Contractor:** Scott Special Projects



Figure 6 Isolation stored on-site to be reused in the same project, **Project:** University Centre - **Contractor:** Scott Special Projects



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Figure 7 Timber frames stored on-site to be reused in the same project, **Project:** University Centre - **Contractor:** Scott Special Projects



Figure 8 Doors stored on-site to be reused in the same project, **Project:** University Centre - **Contractor:** Scott Special Projects



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Figure 9 Lightings, stored on-site to be reused in the same project, **Project:** University Centre - **Contractor:** Scott Special Projects



Figure 10 Lightings, stored on-site to be reused in the same project, **Project:** University Centre - **Contractor:** Scott Special Projects



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Figure 11 Drywalls, separated for recycling, **Project:** University Centre - **Contractor:** Scott Special Projects



Figure 12 **Project:** University Centre - **Contractor:** Scott Special Projects



Figure 13 Old decorative lightings, kept outside of building to be given to anyone who want them for free, **Project:** University Centre - **Contractor:** Scott Special Projects



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Figure 15 Mixed waste, outside of building on project's site, **Project:** University Centre - **Contractor:** Scott Special Projects



Figure 14 Mixed waste, outside of building on project's site, **Project:** University Centre - **Contractor:** Scott Special Projects



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Figure 16 Mixed waste, outside of building on project's site, **Project:** University Centre - **Contractor:** Scott Special Projects



Figure 17 Scrap metal bin outside of building on project's site with a distinguished sign on it, **Project:** University Centre - **Contractor:** Scott Special Projects



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Figure 18 Project: Irving K. Barber Library, Room 310 - **Contractor:** Aberdane Construction



Figure 19 Project: Irving K. Barber Library, Room 310 - **Contractor:** Aberdane Construction



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Figure 20 on-site waste separation - **Project:** Ponderosa Commons - **Contractor:** Ledcor Construction
(Image source: Ledcor Construction)



Figure 21 **Project:** Buchanan B Rooms 202, 204, 206 - **Contractor:** VPAC Construction



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Figure 22 Mixed concrete and shrubberies collected outside of building on project's site, **Project:** Geography Building - **Contractor:** EL Shaddai Construction



Figure 23 Wood waste bin outside of building on project's site (one bin can come in at a time), **Project:** Geography Building - **Contractor:** EL Shaddai Construction



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Figure 24 Wood waste pile collected outside of building on project's site, **Project:** Geography Building - **Contractor:** EL Shaddai Constructio



Figure 25 Dust pile collected outside of building on project's site, **Project:** Geography Building - **Contractor:** EL Shaddai Construction



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Figure 26 Dust pile collected outside of building on project's site, **Project:** Geography Building - **Contractor:** EL Shaddai Construction



Figure 27 Concrete and wood waste piles collected outside of building on project's site, **Project:** Geography Building - **Contractor:** EL Shaddai Construction



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Figure 28 Small drywall bin, inside the building, **Project:** CEME Lab - **Contractor:** Holaco Construction



Figure 29 Old wooden shelves, some of the wood may be used for backing during the construction, **Project:** CEME Lab - **Contractor:** Holaco Construction



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Figure 30 Mixed sweeping waste **Project:** CEME Lab - **Contractor:** Holaco Construction



Figure 31 Mixed sweeping waste **Project:** CEME Lab - **Contractor:** Holaco Construction



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Figure 32 Project: FNH - **Contractor:** Turn-Key Construction



Figure 33 Wood waste in outside of building (one bin can come in at a time), **Project:** Geography Building - **Contractor:** EL Shaddai Construction



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Figure 34 Bonded system piping **Project:** Place Vanier Residence - **Contractor:** Division 15



Figure 35 Project's site **Project:** Place Vanier Residence - **Contractor:** Division

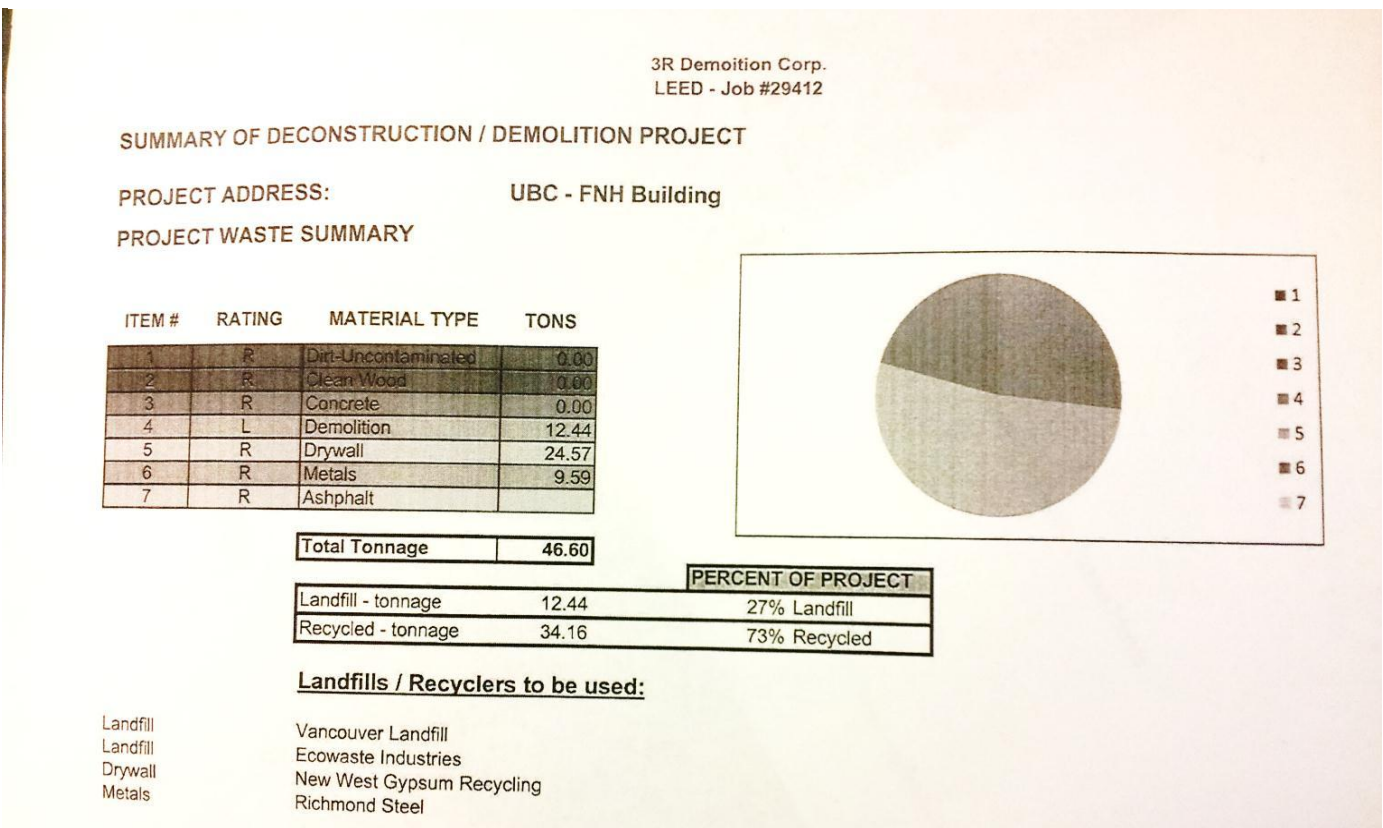


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Appendix 5: Quantity Sheets

Table 1 Quantity Sheets **Project:** FNH Labs, **Contractor:** turn-Key – Brian Adamson





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Table 2 Quantity Sheets Contractor: EL SHADDAI – Mike Briant, Project: Geography Exterior

Value of Construction \$900K.

Project Services Group		Date:		
Waste Disposal Audit report - Demolition Phase				
Project:		Contractor:		
No.	Material	LBS/Sq.ft. - Lin Ft	Recycled (%)	Destination
1	Corrugated Board	25lbs	100%	recycle
2	Wood	1000lbs	100%	recycle
3	Conc.	1000lbs	100%	recycle
4	Block/Brick	N/A		
5	Drywall	others		
6	Florescent tubes	N/A		
7	Light Fixtures	reused		
8	Counters/Cabinets	N/A		
9	Insulations	N/A		
10	Scrap Metal/Steel	500lbs	100%	Scrap yard.
11	Plumbing piping	same as metal		
12	Elect conduit	N/A		
13	Glass	N/A		
14	Flooring	wood only 500lbs	100%	recycle
15	Others			
16				
17				
18				
19				
Waste Disposal Audit report - Construction Phase				
1	Drywall	removed by Abatement crew.		
2	Flooring			
3	Ceiling Tiles	removed by Abatement crew		
4	Others			
5				
6				
7				
8				
9				



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Table 3 Quantity Sheets **Contractor:** Scott Special Projects - **Project:** University Centre

LEED NC version 1.0 Waste Tracking Form				Project Name: UBC Seismic Upgrade									
Waybill or Bin Reference	Date Load Hauled	Recycling Facility (contact info at bottom of table)	Total Material (Kgs)	Garbage (non-recyclable)		Wood		Metal		Concrete		Gypsum	
				%	Kg	%	Kg	%	K	%	Kg	%	Kg
848341	18-Jan-13	New West Gypsum	4,970									100%	4,970
109690	23-Jan-13	Richvan Holdings	5,895								100%	5,895	
2035771	25-Jan-13	Urban Wood Waste	3,540	15%	531	85%	3,009						
61021	25-Jan-13	Allied Salvage	2,497					100%	2,4				
1150589	28-Jan-13	Ecowaste	8,914							100%	8,914		
113080	1-Feb-13	Richvan Holdings	5,895							100%	5,895		
849849	6-Feb-13	New West Gypsum	6,240									100%	6,240
235916	8-Feb-13	Inner City Recycling	3,520	100%	3,520								
163246	12-Feb-13	Richvan Holdings	5,895							100%	5,895		
61862	13-Feb-13	Allied Salvage	1,825					100%	1,8				
1153754	15-Feb-13	Ecowaste	9,280							100%	9,280		
116494	18-Feb-13	Richvan Holdings	5,895							100%	5,895		
116493	18-Feb-13	Richvan Holdings	5,895							100%	5,895		
117005	20-Feb-13	Richvan Holdings	5,895							100%	5,895		
6258	23-Feb-13	Fast Trac Excava ing	5,895							100%	5,895		
1317	25-Feb-13	Richvan Holdings	5,053							100%	5,053		
62780	4-Mar-13	Allied Salvage	2,965					100%	2,9				
1157020	5-Mar-13	Ecowaste	4,060	100%	4,060								
241569	5-Mar-13	Pan Pacific Metals	309					100%	3				
117802	7-Mar-13	Richvan Holdings	5,895							100%	5,895		
1158932	13-Mar-13	Ecowaste	10,472							100%	10,472		
165524	21-Mar-13	Richvan Holdings	5,895							100%	5,895		
863520	21-Mar-13	New West Gypsum	8,160									100%	8,160
63716	21-Mar-13	Allied Salvage	1,589					100%	1,5				
118305	22-Mar-13	Richvan Holdings	5,895							100%	5,895		
Totals			132,344		8,111		3,009		9,1		92,669		19,370

Totals by Waste Type

Type of Waste	Amount of Waste (Kg)
Garbage	8,111
Wood	3,009
Metal	9,185
Concrete	92,669
Gypsum	19,370
Cardboard	0
Dirt/Rubble	0
Clean Fill	0
Other	0
Total Waste	132,344
Total Waste Recycled	124,233
Waste Diverted	93.9%



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Table 4 Quantity Sheets **Contractor:** Scott Construction Group - **Project:** Sauder School of Business Phase III Renovations

Owner: UBC Properties Investments Ltd. as a trustee for UBC Properties Trust					
Contractor: Scott Construction Group					
Project: UBC Sauder School of Business Phase III Renovations					
Document: LEED Materials Tracking					
Scope of Work: Demolition					
Coordinator: Kaj Briscoe					
<u>Date of Bin</u>	<u>Invoice</u>	<u>Location</u>	<u>Weight</u>	<u>Material</u>	<u>% Recycled</u>
09-Apr-11	7206	Mitchel Island Material	12000kg	concrete	100%(12000kg)
11-Apr-11	45251	Waste-Away Disposal	5500kg	30% wood, 70% garbage	30% (1650kg)
12-Apr-11	7206	Mitchel Island Material	12000kg	concrete	100% (12000kg)
19-Apr-11	7206	Waste-Away Disposal	5800kg	25% wood, 75% garbage	25% (1450kg)
20-Apr-11	7206	New West Gypsum	9100kg	gypsum wall board	100% (9100kg)
22-Apr-11	7206	Richmod Steel	3450kg	metal (dirty steel)	100% (3450kg)
26-Apr-11	45302	Waste-Away Disposal	7870kg	25% wood, 75% garbage	25% (1967.5kg)
28-Apr-11	7206	Richmond Steel	4300kg	metal (dirty steel)	100% (4300kg)
29-Apr-11	7206	Mitchel Island Material	12000kg	concrete	100% (12000kg)
03-May-11	45315	Waste-Away Disposal	6100kg	20% wood, 80% garbage	20% (1220kg)
04-May-11	7206	Mitchel Island Material	12000kg	concrete	100% (12000kg)
06-May-11	7206	Richmond Steel	3800kg	metal (dirty steel)	100% (3800kg)
06-May-11	45335	Waste-Away Disposal	6580kg	30% wood, 70% garbage	30% (1974kg)
11-May-11	7264	Mitchel Island Material	12000kg	concrete	100% (12000kg)
13-May-11	45361	Waste-Away Disposal	8200kg	15% wood, 85% garbage	15% (1230kg)
17-May-11	7264	Mitchel Island Material	12000kg	concrete	100% (12000kg)
27-May-11	7264	Mitchel Island Material	12000kg	concrete	100% (12000kg)
02-Jun-11	7305	Mitchel Island Material	12000kg	concrete	100% (12000kg)
03-Jun-11	45378	Waste-Away Disposal	7500kg	30% wood, 70% garbage	30% (2250kg)
07-Jun-11	7305	Richmond Steel	4100kg	metal (dirty steel)	100% (4100kg)
09-Jun-11	7305	Mitchel Island Material	12000kg	concrete	100% (12000kg)
13-Jun-11	7305	Mitchel Island Material	12000kg	concrete	100% (12000kg)
14-Jun-11	45409	Waste-Away Disposal	7200kg	10% wood, 90% garbage	10% (720kg)
15-Jun-11	7305	Richmond Steel	5000kg	metal (dirty steel)	100% (5000kg)
30-Jun-11	7305	Mitchel Island Material	12000kg	concrete	100% (12000kg)
30-Jun-11	45439	Waste-Away Disposal	5800kg	20% wood, 80% garbage	20% (1160kg)
Total Weight:			222,300	Total Recycled:	175,371.5kg
				% Recycled:	79%



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Table 5 Quantity Sheets **Contractor:** Ledcor Construction - **Project:** Ponderosa Commons

Date of Haul [Month DD, YYYY]	Type of Waste [wood, steel, landfill, etc.]	Receiving Facility	Amount of Waste [KG]	Diversion Rate [%]	Amount Diverted [KG]
March 30, 2012	Mr Bin (wood, cb, metal)	Mitchell Island	2390	100%	2390
March 30, 2012	Mr Bin, various	Mitchell Island	5920	100%	5920
April 12, 2012	Mr Bin, various	Mitchell Island	2220	97%	2153.4
April 19, 2012	Mr Bin, various	Mitchell Island	6320	85%	5372
April 4, 2012	Concrete	AWST New West	9500	100%	9500
April 14, 2012	Concrete	AWST New West	9500	100%	9500
April 21, 2012	Concrete	AWST New West	9500	95%	9025
April 24, 2012	Concrete	AWST New West	9500	100%	9500
May 3, 2012	Mr Bin, various	Mitchell Island	3980	97%	3860.6
May 18, 2012	Mr Bin, various	Mitchell Island	3990	97%	3870.3
May 30, 2012	Mr Bin, various	Mitchell Island	4540	95%	4313
May 3, 2012	Concrete	AWST New West	9500	100%	9500
May 3, 2012	Metal, Wood, Cardboard	Urban Wood Waste	4815	90%	4333.5
May 4, 2012	Metal	Davis Trading	2270	100%	2270
May 8, 2012	Wood	Fraser Richmond	10240	100%	10240
May 22, 2012	Wood, Concrete, Plastic	AWST New West	9500	94%	8930
May 29, 2012	Concrete	Ecowaste	4444	100%	4444
May 30, 2012	Metal, Concrete	AWST New West	9500	100%	9500
May 18, 2012	Concrete	AWST New West	9500	100%	9500
May 23, 2012	Metal, Wood, Cardboard	Urban Wood Waste	3985	95%	3785.75
May 29, 2012	Concrete	AWST New West	9500	90%	8550
June 5, 2012	Mr Bin, various	Mitchell Island	3170	94%	2979.8
June 11, 2012	Mr Bin, various	Mitchell Island	5610	96%	5385.6
June 22, 2012	Mr Bin, various	Mitchell Island	4010	93%	3729.3
June 27, 2012	Mr Bin, various	Mitchell Island	3680	96%	3532.8
June 12, 2012	Metal, Concrete	Ecowaste	7660	100%	7660
June 19, 2012	Concrete	Richvan	9500	100%	9500
June 12, 2012	Wood, Concrete	Urban Wood Waste	6155	95%	5847.25
June 20, 2012	Concrete	AWST New West	9500	95%	9025
July 6, 2012	Mr Bin, various	Mitchell Island	3640	95%	3458
July 18, 2012	Mr Bin, various	Mitchell Island	2870	94%	2697.8
July 20, 2012	Mr Bin, various	Mitchell Island	3530	98%	3459.4
July 3, 2012	Wood	Urban Wood Waste	860	100%	860
July 3, 2012	Cardboard	Urban Wood Waste	215	100%	215
July 13, 2012	Metal	Urban Wood Waste	628.5	90%	565.65
July 13, 2012	Wood	Urban Wood Waste	3142.5	90%	2828.25
July 16, 2012	Concrete	AWST New West	9500	100%	9500
July 24, 2012	Metal	Urban Wood Waste	412	95%	391.4
July 24, 2012	Wood	Urban Wood Waste	3296	95%	3131.2
July 24, 2012	Cardboard	Urban Wood Waste	206	95%	195.7
July 30, 2012	Concrete	Richvan	9500	100%	9500
July 31, 2012	Concrete	AWST New West	9500	100%	9500
July 9, 2012	Concrete	AWST New West	9500	100%	9500
July 17, 2012	Concrete	AWST New West	9500	100%	9500



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July 26, 2012	Concrete	AWST New West	9500	100%	9500
July 31, 2012	Wood	Innercity	3120	80%	2496
August 1, 2012	Metal & Wood	Ecowaste	4278	70%	2994.
August 9, 2012	Metal, Wood, OCC	Urban Wood Waste	3760	100	3760
August 15, 2012	Metal, Wood, OCC	Urban Wood Waste	2795	90%	2515.
August 16, 2012	Concrete	AWST New West	9500	100	9500
August 20, 2012	Metal & Wood	Ecowaste	5292	80%	4233.
August 24, 2012	Metal, Wood, OCC	Urban Wood Waste	4925	95%	4678.
August 30, 2012	Concrete	Richvan	9500	100	9500
August 8, 2012	Concrete	AWST New West	9500	100	9500
August 9, 2012	Metal & Wood	Urban Wood Waste	5285	90%	4756.
August 14, 2012	Concrete	Richvan	9500	100	9500
August 20, 2012	Concrete	Richvan	9500	100	9500
August 24, 2012	Concrete	Richvan	9500	100	9500
August 28, 2012	Metal, Wood, OCC	Urban Wood Waste	4610	90%	4149
September 6, 2012	Concrete	AWST New West	9500	100	9500
September 6, 2012	Metal, Wood, OCC	Urban Wood Waste	4275	90%	3847.
September 14, 2012	Metal, Wood	Urban Wood Waste	3395	95%	3225.
September 17, 2012	Concrete	Richvan	9500	100	9500
September 19, 2012	Wood, OCC	Urban Wood Waste	3325	90%	2992.
September 24, 2012	Concrete	Richvan	9500	100	9500
September 27, 2012	Wood, OCC	Urban Wood Waste	4795	80%	3836
September 6, 2012	Metal, Wood	Urban Wood Waste	3750	90%	3375
September 12, 2012	Metal, Wood	Richvan	4360	95%	4142
September 12, 2012	Concrete	Urban Wood Waste	9500	100	9500
September 17, 2012	Wood	Urban Wood Waste	5380	95%	5111
September 24, 2012	Metal, Wood	Urban Wood Waste	4645	90%	4180.
September 25, 2012	Concrete	Richvan	9500	100	9500
October 2, 2012	Metal, Wood	Urban Wood Waste	5325	80%	4260
October 15, 2012	Metal, Wood	Urban Wood Waste	6305	75%	4728.
October 26, 2012	Metal, Wood, OCC	Urban Wood Waste	6670	80%	5336
October 29, 2012	Metal, Wood	Urban Wood Waste	5020	95%	4769
October 2, 2012	Concrete	Richvan	9500	100	9500
October 23, 2012	Concrete	Richvan	9500	100	9500
October 29, 2012	Concrete	Richvan	9500	100	9500
October 2, 2012	Metal, Wood, OCC	Urban Wood Waste	3200	85%	2720
October 11, 2012	Waste	Urban Wood Waste	4395	95%	4175.
October 20, 2012	Metal, Wood	Urban Wood Waste	6760	70%	4732
October 25, 2012	Wood, OCC	Urban Wood Waste	3220	65%	2093
October 31, 2012	Metal, Wood	Urban Wood Waste	5920	90%	5328
October 1, 2012	Concrete	Richvan	9500	100	9500
October 11, 2012	Concrete	Richvan	9500	100	9500
October 18, 2012	Concrete	Richvan	9500	100	9500
October 25, 2012	Concrete	Richvan	9500	100	9500
November 6, 2012	Concrete	Richvan	9500	100	9500
November 13, 2012	Metal, Wood, OCC	Urban Wood Waste	5495	95%	5220.
November 14, 2012	Metal, Wood, OCC	Urban Wood Waste	7435	90%	6691.
November 16, 2012	Concrete	Richvan	9500	100	9500
November 19, 2012	Wood, OCC	Urban Wood Waste	4945	90%	4450.



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November 21, 2012	Concrete	Richvan	9500	100	9500
November 28, 2012	Concrete	Richvan	9500	100	9500
November 28, 2012	Wood	Urban Wood Waste	5040	90%	4536
November 6, 2012	Concrete	Ecowaste	5942	100	5942
November 7, 2012	Metal, Wood, OCC	Urban Wood Waste	6650	80%	5320
November 13, 2012	Metal, Wood, OCC	Urban Wood Waste	6220	85%	5287
November 21, 2012	Concrete	Richvan	9500	100	9500
November 21, 2012	Metal, Wood, OCC	Ecowaste	5236	50%	2618
November 24, 2012	Wood	Urban Wood Waste	7310	85%	6213.
November 28, 2012	Metal, Wood	Urban Wood Waste	5465	90%	4918.
November 30, 2012	Metal, Wood, OCC	Urban Wood Waste	4125	80%	3300
December 3, 2012	Concrete	Richvan	9500	100	9500
December 3, 2012	Concrete	Richvan	9500	100	9500
December 4, 2012	Metal	Davis Trading	2070	100	2070
December 5, 2012	Metal, Wood	Urban Wood Waste	6040	85%	5134
December 10, 2012	Concrete	Richvan	9500	100	9500
December 17, 2012	Metal, Wood	Urban Wood Waste	7040	75%	5280
December 5, 2012	Metal, Wood, OCC	Urban Wood Waste	5765	80%	4612
December 10, 2012	Concrete	Richvan	9500	100	9500
December 11, 2012	Metal, Wood	Urban Wood Waste	5640	85%	4794
December 13, 2012	Concrete	AWST New West	9500	100	9500
December 20, 2012	Metal, Wood, OCC	Urban Wood Waste	6835	65%	4442.
December 20, 2012	Metal, OCC	Urban Wood Waste	3840	85%	3264
December 27, 2012	Concrete	Ecowaste	6262	100	6262
January 4, 2013	Wood, Concrete	Ecowaste	4194	60%	2516.
January 10, 2013	Metal, Wood	Urban Wood Waste	5640	85%	4794
January 14, 2013	Wood	Urban Wood Waste	7545	70%	5281.
January 14, 2013	Metal, Wood, OCC	Urban Wood Waste	6275	65%	4078.
January 16, 2013	Wood, Concrete	Urban Wood Waste	4775	95%	4536.
January 16, 2013	Concrete	Ecowaste	9410	100	9410
January 22, 2013	Concrete	Ecowaste	1012	100	1012
January 25, 2013	Metal, Concrete	Ecowaste	7114	100	7114
January 25, 2013	Metal, Wood, OCC	Urban Wood Waste	5710	85%	4853.
January 30, 2013	Metal, Wood, OCC	Urban Wood Waste	5525	100	5525
January 31, 2013	Metal, Wood, OCC	Urban Wood Waste	4680	65%	3042
January 2, 2013	OCC	Urban Impact-NW	80	100	80
January 3, 2013	Concrete	Ecowaste	1002	100	1002
January 9, 2013	OCC	Urban Impact-NW	40	100	40
January 11, 2013	Metal, Wood	Urban Wood Waste	8705	65%	5658.
January 14, 2013	Metal, Wood	Urban Wood Waste	4080	60%	2448
January 16, 2013	OCC	Urban Impact-NW	40	100	40
January 17, 2013	Concrete	Ecowaste	1122	100	1122
January 22, 2013	Wood	Urban Wood Waste	6690	85%	5686.
January 23, 2013	OCC	Urban Impact-NW	60	100	60
January 25, 2013	Metal, Wood, OCC	Urban Wood Waste	5855	85%	4976.
January 30, 2013	Concrete	Ecowaste	1195	100	1195
January 30, 2013	OCC	Urban Impact-NW	40	100	40
February 1, 2013	Metal, Wood	Urban Wood Waste	5340	80%	4272
February 5, 2013	Metal, Wood	Urban Wood Waste	2910	95%	2764.



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February 7, 2013	Metal, Wood, OCC	Urban Wood Waste	4360	40%	1744
February 8, 2013	Wood	Urban Wood Waste	2830	95%	2688.
February 8, 2013	Concrete	Urban Wood Waste	7846	100	7846
February 12, 2013	Metal, Wood	Ecowaste	4895	95%	4650.
February 12, 2013	Wood	Urban Wood Waste	3040	75%	2280
February 13, 2013	Metal, Wood, OCC	Urban Wood Waste	3295	55%	1812.
February 14, 2013	Wood	Urban Wood Waste	3030	85%	2575.
February 18, 2013	Metal, Wood	Urban Wood Waste	4365	85%	3710.
February 18, 2013	Wood	Urban Wood Waste	1145	85%	973.2
February 20, 2013	Metal, Wood, OCC	Urban Wood Waste	6415	50%	3207.
February 22, 2013	Wood	Urban Wood Waste	3785	90%	3406.
February 25, 2013	Metal, Concrete	Ecowaste	7346	95%	6978.
February 27, 2013	Gypsum	New West Gypsum	1550	100	1550
February 27, 2013	Wood	Ecowaste	2854	25%	713.5
February 28, 2013	Metal, Wood	Urban Wood Waste	4160	75%	3120
February 1, 2013	Metal, Wood, OCC	Urban Wood Waste	3840	90%	3456
February 4, 2013	Metal, Wood	Urban Wood Waste	3540	75%	2655
February 7, 2013	OCC	Urban Impact	80	100	80
February 7, 2013	Wood	Urban Wood Waste	5940	90%	5346
February 13, 2013	Metal, Wood	Urban Wood Waste	5530	95%	5253.
February 13, 2013	Metal, Wood, OCC	Urban Wood Waste	1165	30%	349.5
February 13, 2013	OCC	Urban Impact	60	100	60
February 14, 2013	Metal, Wood	Urban Wood Waste	4920	100	4920
February 20, 2013	Metal, Wood	Urban Wood Waste	5315	95%	5049.
February 20, 2013	OCC	Urban Impact	60	100	60
February 21, 2013	Wood	Urban Wood Waste	4565	90%	4108.
February 22, 2013	Metal, Wood	Urban Wood Waste	5035	70%	3524.
March 7, 2013	Metal, Wood	Ecowaste	3510	70%	2457
March 8, 2013	Metal, Wood	Urban Wood Waste - SPRUCE	4230	80%	3384
March 8, 2013	Metal, Wood, Cardboard	Urban Wood Waste - MAIN	2880	95%	2736
March 11, 2013	Concrete	Ecowaste	6140	100	6140
March 12, 2013	Metal, Wood	Ecowaste	3670	45%	1651.
March 21, 2013	Metal, Wood	Ecowaste	4250	30%	1275
March 21, 2013	Metal, Wood	Ecowaste	2910	0%	0
March 27, 2013	Concrete	Ecowaste	5840	100	5840
March 28, 2013	Metal, Wood, Cardboard	Ecowaste	2580	35%	903
March 28, 2013	Metal, Wood, Cardboard	Urban Wood Waste - MAIN	1985	80%	1588
March 6, 2013	Wood	Ecowaste	5512	45%	2480.
March 7, 2013	Cardboard	Urban Impact-NW	60	100	60
March 14, 2013	Cardboard	Urban Impact-NW	20	100	20
March 21, 2013	Cardboard	Urban Impact-NW	40	100	40
March 21, 2013	Metal, Wood, Cardboard	Urban Wood Waste - MAIN	2820	85%	2397
March 25, 2013	Metal, Wood, Cardboard	Urban Wood Waste - MAIN	4355	80%	3484
March 25, 2013	Metal	Davis Trading	1730	100	1730
March 28, 2013	Cardboard	Urban Impact-NW	80	100	80



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March 6, 2013	Gypsum	New West Gypsum	5920	100	5920
March 25, 2013	Gypsum	New West Gypsum	5950	100	5950
April 3, 2013	Cardboard	Urban Impace	40	100	40
April 4, 2013	Wood	Urban Wood Waste	3790	90%	3411
April 8, 2013	Metal	Davis Trading	1060	100	1060
April 10, 2013	Cardboard	Urban Impact	40	100	40
April 16, 2013	Metal	Davis Trading	1100	100	1100
April 17, 2013	Cardboard	Emterra	80	100	80
April 24, 2013	Cardboard	Urban Impact	80	100	80
April 25, 2013	Metal, Wod, Cardboard	Urban Wood Waste	4440	70%	3108
April 25, 2013	Metal	Davis Trading	920	100	920
April 29, 2013	Cardboard	Urban Impact	80	100	80
April 30, 2013	Metal	Davis Trading	1070	100	1070
April 1, 2013	Cardboard	Urban Impact	60	100	60
April 8, 2013	Wood	Ecowaste	2510	30%	753
April 12, 2013	Metal, Wood, Cardboard	Urban Wood Waste	3690	80%	2952
April 16, 2013	Wood, Cardboard	Urban Wood Waste	2660	75%	1995
April 19, 2013	Metal, Wood	Ecowaste	2470	55%	1358.
April 23, 2013	Metal, Wood, Cardboard	Urban Wood Waste	2665	80%	2132
April 24, 2013	Concrete	Ecowaste	7116	100	7116
April 26, 2013	Wood, Cardboard	Urban Wood Waste	2775	60%	1665
April 29, 2013	Cardboard	Emterra	80	100	80
April 30, 2013	Wood, Cardboard	Ecowaste	3060	63%	1927.
April 9, 2013	Gypsum	New West Gypsum	6010	100	6010
April 12, 2013	Gypsum	New West Gypsum	6020	100	6020
April 17, 2013	Gypsum	New West Gypsum	5980	100	5980
April 25, 2013	Gypsum	New West Gypsum	4710	100	4710
April 26, 2013	Gypsum	New West Gypsum	6320	100	6320
May 1, 2013	Cardboard	Emterra	80	100	80
May 3, 2013	Metal	Davis Trading	1350	100	1350
May 8, 2013	Cardboard	Emterra	80	100	80
May 9, 2013	Metal	Davis Trading	1160	100	1160
May 13, 2013	Metal, Wood, Cardboard	Ecowaste	2810	65%	1826.
May 15, 2013	Metal	Davis Trading	970	100	970
May 15, 2013	Cardboard	Urban Impact	240	100	240
May 22, 2013	Cardboard	Urban Impact	160	100	160
May 24, 2013	Metal	Davis Trading	1750	100	1750
May 29, 2013	Cardboard	Urban Impact	140	100	140
May 31, 2013	Metal, Wood	Ecowaste	3080	65%	2002
May 2, 2013	Cardboard	Urban Impact	80	100	80
May 2, 2013	Metal, Wood, Cardboard	Ecowaste	2040	70%	1428
May 7, 2013	Metal, Wood, Cardboard	Urban Wood Waste	3895	40%	1558
May 9, 2013	Metal, Wood, Cardboard	Ecowaste	2710	75%	2032.
May 14, 2013	Concrete	Ecowaste	6286	100	6286
May 15, 2013	Wood, Cardboard	Urban Wood Waste	2325	60%	1395
May 15, 2013	Metal, Wood, Cardboard	Urban Wood Waste	2965	60%	1779
May 21, 2013	Metal, Wood, Cardboard	Urban Wood Waste	2525	70%	1767.5
May 22, 2013	Metal, Wood	Ecowaste	2290	78%	1786.2



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May 27, 2013	Wood	Urban Wood Waste	2350	65%	1527.
May 28, 2013	Wood	Ecowaste	5210	90%	4689
May 30, 2013	Wood, Cardboard	Urban Wood Waste	2280	90%	2052
May 30, 2013	Metal	Davis Trading	1500	100	1500
May 3, 2013	Gypsum	New West Gypsum	5870	100	5870
May 6, 2013	Gypsum	New West Gypsum	5170	100	5170
May 8, 2013	Gypsum	New West Gypsum	5620	100	5620
May 13, 2013	Gypsum	New West Gypsum	6000	100	6000
May 17, 2013	Gypsum	New West Gypsum	6220	100	6220
May 29, 2013	Gypsum	New West Gypsum	5300	100	5300
May 30, 2013	Gypsum	New West Gypsum	3780	100	3780

Total quantity of waste diverted from landfill: 1100182.65 KG
Total quantity of waste taken offsite: 1212409 KG
Percentage of waste diverted: 90.7%

Table 6 Quantity Sheets **Contractor:** VPAC Construction - **Project:** Buchanan B Rooms 202, 204, 206

	A	B	C	D	E	F
1						
2	Project Services Group					Date: 31/07/13
3	Waste Disposal Audit Report - Demolition Phase					
4						
5	Project: Buchanan B		B202, B204, B206			
6	Contractor: VPAC		Construction			
7						
8	Material	LBS/Sq.ft	% Recycled	Destination	Comments	
9		Lin Ft				
10	1 Corrugated board					
11	2 Wood					
12	3 Conc.					
13	4 Block/ brick					
14	5 Drywall	1350 sqft	100%	New West Gypsum		
15	6 Florescent tubes					
16	7 Light fixtures					
17	8 Counters/cabinets					
18	9 Insulation	540 sqft	100%	URBAN wood waste		
19	10 Scrap metal/Steel	500 LKft	100%	Joss Brothers	2X4 82X6 studs	
20	11 Plumbing piping					
21	12 Elect conduit	200 LKft	100%	Joss Brothers		
22	13 Glass					
23	14 Flooring					
24	15 Other					
25						
26						
27	Waste Disposal Audit Report - Construction Phase					
28						
29	1 Drywall					
30	2 Flooring					
31	3 Ceiling Tiles					
32	4 Other					
33	5					
34	6					
35	7					
36	8					