Building and construction waste materials: REDUCE, REUSE AND RECYCLE - Opportunities and strategies for the Capital region
Building and Construction Waste Materials: Reduce, Reuse and Recycle - Opportunities and Strategies for the Capital Region

In December 2013 Canberra Business Council, through its Sustainability Special Interest Group, led a project which commissioned the University of Canberra to undertake research into residential construction, renovation and demolition (C&D) waste and recycling activity in the Capital Region. Canberra Business Council was joined in this project by the South East Regional Organisation of Councils (SERROC), the ACT Master Builders Association (MBA), ACT NOWaste, Colin Stewart Architects, Easycare Landscapes, the ACT Land Development Agency, and the Rock Development Group. The research proponents together represent the business sector, the architecture, landscape architecture, building and construction industries and the local government areas which constitute the Capital Region.

Note: Although this project was commenced in December 2013 by Canberra Business Council, on 1 October 2014, Canberra Business Council came together with the ACT and Region Chamber of Commerce and Industry to form a new organisation - Canberra Business Chamber – a single voice for business in Canberra and the Capital Region.

As a consequence of this merger, the Building And Construction Waste Materials: Reduce, Reuse And Recycle - Opportunities And Strategies For The Capital Region Report is presented under the Canberra Business Chamber branding.
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ABBREVIATIONS

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Full Form</th>
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<tbody>
<tr>
<td>ACT</td>
<td>Australian Capital Territory</td>
</tr>
<tr>
<td>C&amp;D</td>
<td>Construction and Demolition (waste)</td>
</tr>
<tr>
<td>C&amp;I</td>
<td>Commercial and Industrial (waste)</td>
</tr>
<tr>
<td>EPA</td>
<td>Environmental Protection Authority</td>
</tr>
<tr>
<td>Fines</td>
<td>Very small particles</td>
</tr>
<tr>
<td>MBA</td>
<td>ACT Master Builders Association</td>
</tr>
<tr>
<td>MSW</td>
<td>Municipal Solid Waste</td>
</tr>
<tr>
<td>NSW</td>
<td>New South Wales</td>
</tr>
<tr>
<td>RCA</td>
<td>Recycled concrete aggregate</td>
</tr>
<tr>
<td>SEROC</td>
<td>South East Region of Local Councils</td>
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<tr>
<td>SERRG</td>
<td>South East Resource Recovery Group</td>
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<tr>
<td>VENM</td>
<td>Virgin Excavated Natural Material (soil)</td>
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EXECUTIVE SUMMARY

Concern has been expressed by building and construction industry representatives that the residential component of building, construction and demolition waste (C&D) in the Capital Region (13 local government groups of the South East Region of NSW and the Australian Capital Territory) is largely being disposed to landfill. The local governments and the ACT Government are highly interrelated in terms of commerce, employment and industry infrastructure. Waste cannot and should not be dealt with in isolation from considerations of frameworks and issues in the other council areas or the ACT. Builders in the area work seamlessly across the borders and use all the facilities where it is economic for them to do so. Illegal dumping of soil has become a serious issue for surrounding council areas especially when there are no alternatives for disposal in the ACT or it is cheaper.

Construction and demolition waste is generally accepted to consist of asbestos and asbestos contaminated waste, contaminated soil, concrete products, soil, timber, fines, clay products (bricks and tiles), natural aggregates, garden vegetation, ferrous and non-ferrous metals, plasterboard, paper and cardboard, plastic, textiles, asphalt, glass and other miscellaneous materials (DECCNSW, 2007). However, the composition of what is classified as C&D waste varies.

Lack of consistent and accurate data is an issue with waste in Australia. This study found that there is very limited data on non-domestic waste in the Capital Region. There are problems with lack of collection of data, different measurement practices (weight/tonnes and volume/cubic metres), lack of ability to measure (no equipment to weigh), different definitional practices for C&D waste; different ways of handling waste throughout the region and different practices by consumers of waste services on how they dispose of waste (mixed with commercial and industrial waste, mixed with domestic waste). This is a major problem for this sector. In addition to the lack of data on non-domestic waste there is little corresponding data on the demand for recycled products.

Despite this, various studies have been undertaken which provide guidance on the levels of ‘waste’ generated in the construction of residential buildings. RMIT (2014) has estimated that construction of a typical Australian brick veneer home generates up to 9.1 tonnes of waste particularly if no measures are taken to conserve materials. The amount of C&D waste produced through home building and home renovation in the Capital Region is estimated by this study to be about 399,000 tonnes per annum. However 90% of the respondents to this study’s survey of builders indicated that they recycled some material.

NSW statistics indicate that currently that State recycles around 75% of C&D waste (2010-11). Their goal is 80% by 2021 (NSW EPA, 2013). Work by the South East Region of Local Councils (2013) indicates that the level of C&D recycling in the Capital Region is estimated to
be at 50%, well below the NSW average and well below international best practice being achieved in Germany (92%) and the Netherlands (almost 100%) (FMENCNS, 2012; Brennen et al 2014).

The practice in the ACT is for recyclable waste to be taken in mixed loads to the recycling centres and sorted there. In the regional local government areas, excepting Queanbeyan which disposes to the ACT facilities, various landfill sites operate with different capacities and policies regarding recycling and disposal of C&D materials. Indications are that much of the product is disposed to landfill due to non-sorting and contamination and lack of facilities to sort and/or capacity to remanufacture into reusable materials.

There are considerable barriers to the encouragement of more recycling in the region.

1. Lack of knowledge about what can be recycled or what recycling opportunities exist within the region;
2. Contamination of recyclables due to lack of separation;
3. Alternatives to recycling are less costly – landfill gate prices are too low;
4. Government policy is not driving recycling;
5. Lack of information regarding industry infrastructure;
6. Lack of knowledge across industry and requirement for training;
7. Low value products/low volume products being landfilled rather than stored for recycling because it is uneconomic to stockpile;
8. C&D material is not widely considered by builders as a potential resource (except metal);
9. Environmental regulations are working against recycling;
10. Lack of facilities for recycling;
11. Inconvenience of location of recycling facilities or need to take materials to many different places;
12. Material specification in buildings not encouraging recycling;
13. Lack of facilities to store soil particularly VENM for reuse later; and
14. Different budget and management structures between jurisdictions preventing cooperation in certain areas.

However, the study found that certain stakeholders in the industry (builders, recyclers and waste managers) are keen to recycle more. They are receptive to a number of measures to increase the level of recycling and reduce activity which is damaging to the environment such as dumping. These include:

- Training;
- Media and information campaigns;
- Materials research;
• Investigation into material specifications;
• Using procurement to generate demand and change culture;
• Regulation to force sorting;
• Amendments to fees and charges to incentivise recycling;
• Industry support and business development;
• Changes to planning requirements to enable localised sorting and recycling centres;
• Prevention of cherry-picking of the most valuable recyclables;
• Manning and professionalisation of waste facilities; and
• Dissemination of information to stakeholders through social media mediums.

The study includes other strategies not identified by the local stakeholders which could be considered as part of an overall regional approach.
Arising from these findings, this study makes the following recommendations:

**Recommendation 1**: Consider requiring pre-sorting of C&D materials. Transition-in requirements to sort so that industry can get ready.

**Recommendation 2**: Review the effectiveness of Development Application (DA) waste related plans that (given they appear not to be followed through by government officers) with an option being to set this process aside for residential development except for plans in relation to location of waste facilities in multi-unit facilities.

**Recommendation 3**: Enforce/require Waste Transfer Certificates for all loads showing origin address and content for the recycler or waste management. Make the home owner, land owner take responsibility for the waste by having to sign the docket.

**Recommendation 4**: Pricing – use pricing to provide penalties for contamination of loads and reward sorting. Where there are mixed loads due to small quantities, make these a higher price.

**Recommendation 5**: Education and training, Provide courses for building cadets and apprentices; provide education and training for tip operators.

**Recommendation 6**: Provide education, including using media, for the public and the industry on sorting of building and renovation materials, and bagging of building materials.

**Recommendation 7**: In consultation with the EPA’s, establish sites for storage of VENM eg quarries. Quarries should be considered as potential sites for business development in materials recycling. These should be manned and gated and allow tipping of clean VENM with certification – penalise dumping and other materials.

**Recommendation 8**: On new residential developments of large size plan to have a temporary centralised waste area for builders to leave sorted waste for pick up by recyclers during the development.

**Recommendation 9**: Establish a website or telephone application to develop a market or exchange in soil.

**Recommendation 10**: Establish a regional website or telephone application to provide information about the location, opening hours and restrictions of all landfill sites.

**Recommendation 11**: Pilot social enterprises being involved in sorting construction and demolition wastes on projects through government and private sector contracts.

**Recommendation 12**: Require a demonstrated waste management culture and policy under Prequalification systems for government contracts.
**Recommendation 13:** Require Tenders for government contracts to have criteria which favour recycling of materials.

**Recommendation 14:** Determine and fix a standard and protocol for the collection of C&D waste data.
CHAPTER 1.0 INTRODUCTION

1.1 BACKGROUND AND RESEARCH REQUIREMENTS

A group of organisations including the Canberra Business Council (CBC), the South East Regional Organisation of Councils (SERROC), the ACT Master Builders Association (MBA), ACT NO Waste, Colin Stewart Architects, Easycare Landscapes, the ACT Land Development Agency, and Rock Development Group engaged the University of Canberra in December 2013 to undertake research into residential construction, renovation and demolition (C&D) waste and recycling activity in the Capital Region. The research proponents represent the business sector, the architecture, landscape architecture, building and construction industries and the local government areas which constitute the Capital Region.

Concern was being raised that residential building and construction waste in the Capital Region was largely being disposed to the various landfill sites in the region and that not only was not enough being done in the region to encourage greater recycling activity and the business and economic benefit that can be generated from waste and recycling, but also the landfills were coming under pressure.

1.2 THE SCOPE OF THIS STUDY

This study is focused on the Capital Region. The territory which constitutes the Capital Region has a population of approximately 613,600 (ABS, 2012 Regional Population Growth Aust 2010 -2011 Cat. No. 3218.0) with 60% of that (365,000 people) living in the Australian Capital Territory (ACT). The remaining 248,000 people live in the local government areas surrounding the ACT and these are largely low density rural areas with small townships excepting the coastal fringe which has a mix of tourism, manufacturing, agriculture and service industries (SEROC, 2013).

The Capital Region is situated in the south-east of New South Wales (see Figure 1 below) and encompasses the Australian Capital Territory. The region is united by proximity to the Capital and major population centre (Canberra) and its employment, education, health and business opportunities but also due to the history of the development of the area. Major towns in the region include Queanbeyan, Bega, Merimbula, Batemans Bay, Goulburn, Yass, Young, Braidwood, Bungendore, Cooma and Jindabyne. Smaller towns and villages include Bombala, Boorowa, Moruya, Harden, Berridale, Crookwell, Gundaroo, Sutton and Gunning (SEROC, 2013).

Construction is an important industry sector in the Capital Region with only the Public Administration, Retail and Health Sectors employing more (Garlick, S., 2012). ‘Building and construction comprises around 14 per cent of the region’s output value and around nine percent of employment and is a significant contributor to waste in the SEROC region’
Builders tend to be licensed to operate in both NSW and the ACT and work seamlessly throughout the region.

Building and construction waste was identified in a 2012 study for the South East Resource Recovery Group (SERRG) as one of the industry sectors ‘worth targeting in a waste strategy focussed on enhancing regional economic development’ (Garlick, S., 2012, pp17).

However, there are several challenges to business development through waste capture and recycling in the Capital Region. Firstly, there is the existence of differing governance arrangements with two levels of government (State/Territory and local government) and 13 member Councils making up the local government group (SEROCC) (Bega Valley Shire Council, Bombala Shire Council, Boorowa Shire Council, Cooma-Monaro Shire Council, Eurobodalla Shire Council, Goulburn Mulwaree, Harden Shire Council, Palerang Council, Queanbeyan City Council, Snowy River Shire Council, Upper Lachlan Shire Council, Yass Valley Council and Young Shire Council) all situated within the State of New South Wales and related to the Australian Capital Territory with its separate governance arrangements. Secondly, compared to the ACT, the regional local government areas surrounding the capital lack scale due to low population density and small scale economic development activity.

Figure 1: Capital Region

The accessibility of the region makes it commercially viable for builders to access various facilities. This means that they utilise the services of all of the jurisdictions and will not hesitate to transport material to neighbouring local government landfill sites if it is more economical to do so. This presents a challenge to the governments of this region to work together to devise collaborative strategies to address the C&D waste problem.

1.2 Research Aims
The aims of this research project are to:

- Identify the types and scale of reusable and recyclable materials generated in residential construction, renovation and demolition;
- Identify possible reuse and recycling methods;
- Identify barriers, risks and opportunities (such as cost-benefit, time pressure, product quality, demand, acceptability and incentives) in the recycling/reuse process;
- Investigate strategies that may facilitate material reduce, reuse and recycling from stakeholder perspectives. Where possible, foster the establishment of new or expanding enterprises utilising the results of this research project and build the results of this research project into ACT and NSW regional relevant strategy documents and ongoing strategic implementation processes.

1.3 Research Process and Methodology
The following research methods were utilised to undertake the research into residential C&D waste and recycling in the Capital Region:

1. Desktop research to identify the types of waste material generated from residential building;
2. Focus group workshops with invited participants from the building and construction industry and government waste managers
3. Interviews with Waste Management Facility Operators; and
4. Surveys of residential builders.

The research approach included the following steps:

Step 1: Identify recyclable types and scale of materials

Based on the data already available from SEROC, SERRG and participating companies, a review of the literature and analysis of the available data was undertaken regarding C&D waste streams and to identify any missing data. Data and support was provided from SERRG and the industry participating companies. The study focussed on the following types of waste, namely metal, concrete, brick and tile, glass, timber and plasterboard. Although not a focus of the research, soil spoil such as virgin excavated natural material (VENM) and issues with its storage or disposal was frequently raised and therefore reported in this study.
Step 2: Identify possible reuse methods and potential market demands

Desktop research was conducted to identify the possible reuse methods. The methods were verified by industry practitioners via focused workshops and interviews. Further, potential market demand (i.e. opportunity) was analysed via literature review, focused workshop and interviews.

Step 3: Identify barriers (including cost) in the reuse and recycle process

Barriers and risks (such as cost, time, quality, acceptability, and incentive), were first identified from a review of the literature, then focus group workshops were organised to validate the findings from this literature review. A desktop study was carried out to identify and classify components of costs followed by interviews to confirm costing data.

Step 4: Investigate strategies for reusing and recycling

Possible strategies for overcoming the barriers were considered and future actions (or new business models, and training plans) for relevant stakeholders were developed through literature review and focus group workshops. Suggestions were made for putting the research findings into practice.

Step 5 Summarise and preparation of report

This final step included summarising the findings of the review, preparation of the report and associated material for the research stakeholders.

1.3.1 Focus Group Workshops

Five workshops were conducted in the South East NSW Region and the ACT. See Appendix 2 for the summary of outcomes. The workshops invited representatives of the residential building and construction sector, recycling enterprises and council staff members to validate the findings from the previous desktop research activities and to identify barriers, issues and strategies for waste minimisation and recycling. The workshops were held in Queanbeyan, Moruya, Yass, Young and Canberra on the 5th, 7th, 12th, 14th, 19th August 2014 respectively.

Lists of prospective attendees were compiled using a ‘Yellow Pages’ analysis of residential builders and recycling firms in the target workshop area. These were then telephoned and invited to attend. Follow up emails were sent to the target list. In addition, the local government waste management representatives were also invited. Although attendances at many of the workshops were low the diversity of attendees meant that discussions were broad-ranging and fruitful.
<table>
<thead>
<tr>
<th>Workshop</th>
<th>Venue</th>
<th>Date and time</th>
<th>Attendance Numbers</th>
<th>Groups represented by attendees</th>
</tr>
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<tbody>
<tr>
<td>Queanbeyan</td>
<td>Jim Snow Room, RB Smith Community Centre, 262 Crawford Street, Queanbeyan City</td>
<td>Tuesday 5th August 2014, 3.00pm-5.00pm</td>
<td>4</td>
<td>Local and regional council waste management, local residential builder, local demolition company</td>
</tr>
<tr>
<td>Moruya</td>
<td>Luhana Motel, 82 Princess Highway, Moruya</td>
<td>Thursday 7th August 2014, 3.00pm-5.00pm</td>
<td>13</td>
<td>Local council waste management, local residential builder, local quarry operator, local metals recycler, skip operator, and social enterprise.</td>
</tr>
<tr>
<td>Yass</td>
<td>The Board Room, Yass Soldiers Club, 86 Meehan Street, Yass</td>
<td>Tuesday 12th August 2014, 3.00pm-5.00pm</td>
<td>3</td>
<td>Local council waste management, cabinet making business</td>
</tr>
<tr>
<td>Young</td>
<td>The Ibis Room, Young Services Club, 42 Cloete Street, Young</td>
<td>Thursday 14th August 2014, 3.00pm-5.00pm</td>
<td>7</td>
<td>Local residential builders and maintenance providers, a local demolition company and a civil contractor</td>
</tr>
<tr>
<td>Canberra</td>
<td>The Board Room, Master Builders Association ACT, 1 Iron Knob Street, Fyshwick</td>
<td>Tuesday 19th August 2014, 3.00pm-5.00pm</td>
<td>10</td>
<td>ACT NoWaste (government), small and large residential builders, local recycling business.</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td></td>
<td><strong>37</strong></td>
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**Workshop 1: Queanbeyan 5 August 2014**

Although attendance at this workshop was disappointing the diversity and spread of the small number of attendees provided for a good discussion of local issues, barriers and opportunities. C&D waste from the Queanbeyan City Council area is disposed to the ACT Waste Management and Recycling Centre at Mugga.

**Workshop 2: Moruya 7 August 2014**

The Moruya Workshop was well attended by a very diverse group including a large contingent from local council waste management, a residential builder, a quarry operator, a local metals recycler, a skip operator and a significant local social enterprise.
Workshop 3: Yass 12 August 2014
Attendance at this workshop was also low, however, it attracted a business which was not represented at the other workshops and this enabled a further rich conversation about the issues surrounding building and construction waste and recycling.

Workshop 4: Young 14 August 2014
This workshop again had a very diverse group of attendees including representatives of the local residential builders and maintenance providers, demolition contractors and civil construction contractors.

Workshop 5: Canberra 19 August 2014
The Canberra workshop was well attended with representatives of large and small residential building contractors, the waste recycling industry, and government waste management.

See Appendix 2 for a summary of the Workshop outcomes.

1.3.2 Telephone and Personal Interviews
The purpose of the phone and personal interviews was to gain additional information from the waste management and recycling sector on issues associated with C&D waste and recycling in the Capital Region and to confirm some of the findings from the workshops.

On 4 September 2014 electronic questionnaires were sent to relevant waste and recycling managers of 6 Shires (Young, Goulburn Mulwaree, Yass, Snowy River, Cooma, and Eurobodalla) and the ACT, one construction products manufacturer/producer, one private sector waste manager and one building products recycler. Each recipient holds senior management positions in local government or private enterprise. The pre-interview questionnaire was sent out to allow the respondents to prepare for follow up telephone and personal interviews.

Over the next fortnight, 7 of the 9 responded with answers to the circulated questionnaires and were subsequently telephoned to discuss and clarify some of their responses. Two chose not to return the completed questionnaire but be interviewed by phone/in person. They were the recycler who was interviewed by phone on 10th September 2014 and a waste manager who was interviewed on 18th September 2014.

During the interviews, clarification was sought on their responses to some of the questions and to obtain more detailed information on others. In the case of the waste management group this was particularly useful in sourcing information regarding the 8 shires that they are responsible for.
See Appendix 4 for a summary of the Telephone and Face to Face Interview outcomes.

1.3.3 Survey of Residential Builders
On behalf of the research group, the Master Builders ACT forwarded an electronic survey out to 400 residential builder members to also assist in confirming some of the issues raised by the workshops. Twenty-seven responses were received. Details of the Questionnaire can be found at Appendix 3. The purpose of the questionnaire was to collect data on the amount and type of residential building and construction waste that was being generated in the Capital Region. Builders were asked about the amount and types of building waste they generated and if they recycled any product. The 7% sample although small, provides some indicative data which has been cross referenced with other studies about the level and type of waste produced by residential building in Australia and overseas to estimate quantities produced in the region. One of the issues with the data is the mix of residential type (single dwelling versus, multi-storey and unit complexes), project volume (one project at a time versus several) type of construction method (amount of prefabrication or all bespoke) and type of materials (brick, weatherboard, and metal/colour bond) which generate different volumes of waste.

1.3.4 Methods used to analyses the research data and Material
Transcripts were produced of all of the workshops and a summary of outcomes developed at Appendix 2. Similarly, the telephone and personal interviews were recorded and summarised. In order to protect privacy none of the original transcripts will be published. A summary is available at Appendix 4. The data obtained from the survey of residential builders provided affirmation of the types of materials being recycled. Due to interpretation and other issues, the survey material was only used for this purpose. See Appendix 5 for the Survey Questions.

1.4 Report Layout
Chapter 1 provides the background to the research, its aims and methodology. Chapter 2 looks at the components of C&D waste, the kinds of waste generated in the building and demolition process and the waste hierarchy. It also summarises some comparative international analysis of approaches to C&D waste. Chapter 3 provides an overview and data on the amount of C&D waste being generated in the Capital Region. Chapter 4 considers what materials can be recycled. Chapter 5 examines the barriers to avoiding, reducing or recycling waste. Chapter 6 looks at the strategies to address C&D waste identified by the stakeholders and also presents some further strategies addressed in the literature. Chapter 7 provides the conclusions and recommendations of this study.
CHAPTER 2.0 CLASSIFYING AND QUANTIFYING CONSTRUCTION AND DEMOLITION WASTE

2.1 WHAT IS CONSTRUCTION AND DEMOLITION WASTE?

The construction industry is often compared to a manufacturing process. Taiichi Ohno (1978) who is credited with inventing the just-in-time system of manufacturing identified seven waste groupings: unnecessary movement of labour; staff standing idle waiting for the next activity; product defects; overproduction of goods; idle inventory; over-processing; and inefficient transportation (see also Formoso et al, 2002). However the building and construction industry does not lend itself to an exact comparison with manufacturing processes as all new production is to some extent unique and not all processes are standard. Nevertheless this provides a good starting point particularly with respect to waste from product defects, overproduction of goods, over-processing and transportation.

Other perspectives on waste include the concept of value. ‘Considering that material waste is an important issue for the construction industry, waste is defined ... as the loss of any kind of resources—materials, time (labour and equipment), and capital—produced by activities that generate direct or indirect costs but do not add any value to the final product from the point of view of the client’ (Formoso et al, 2002). Skoyles (1976) classified building and construction waste into direct (materials which are damaged or lost during the construction process) and indirect (monetary waste due to substitution or inefficiency).

This report concentrates on the material waste produced by the building and construction industry during the construction process and lifecycle of a residential project and excludes time inefficiencies in labour productivity and transport. Therefore the definition of construction waste in this study is any material from the building process which is used onsite as landfill or is transported offsite for reuse, recycling, or landfill elsewhere.

C&D waste generally includes bricks, tiles, masonry, cement, timber, metals, plastics and cardboard. The method used to compile data for Waste and Recycling in Australia 2011, excluded clean fill from the scope of C&D waste. For the purposes of this report, clean fill refers to earthen material in a raw or unrefined state (including soil, sand, and rock) or virgin excavated natural material (VENM). In some jurisdictions clean fill, or materials that can be construed as clean fill, are included in the calculation of C&D waste. VENM and the disposal of contaminated soil products were raised as issues during this study.

2.2 WHY IS CONSTRUCTION AND DEMOLITION WASTE GENERATED?

There are many causes of the generation of waste in the construction industry and Table 1 below provides an indication of the drivers of waste throughout the procurement lifecycle of a construction project either through design, procurement, materials handling, construction or maintenance of the built environment.
The Table below is adapted from the categories identified by Bossink and Brouwers (1996), but there are various literatures which have categorised building and construction waste and its causes.

“Gavilan and Bernold (1994) identified waste sources in construction as design, procurement, material handling, operation, residual and other. Bossink and Brouwers (1996) adopted a similar approach to extend the list of sources and respective causes. For the latter, it is important to note that ‘procurement’ represents ‘material procurement’ and not a ‘contract strategy’. Similarly Pinto (1989), Soibelman et al. (1994), and Pinto and Agopayan (1994) [cited in Bossink and Brouwers,1996] related construction waste to material types such as steel, cement, concrete, sand, mortar, ceramic block, brick, timber, hydrated lime, wall ceramic lime, wall ceramic tile and floor ceramic tiles. On the other hand, Keys et al. (2000) classified waste origins under the headings of manufacture, procurement, supplier, designer, logistics, client, contractor and site management. However, Ekanayake and Ofori (2000) categorised construction waste causes under four main categories as design, operational, material handling and procurement (material), whereas Osmani et al. (2007) adopted a life cycle approach to construction waste origins from inception to completion. These sources demonstrate that waste origins are attached to different elements of a procurement system such as: design related origins to design element, contractual origins attach to the contact strategy, procurement, transportation, on site management and planning, material handling and storage, and site operations attached to construction” (Gamage, Osmani and Glass, undated).

Table 2: Sources and causes of construction waste

<table>
<thead>
<tr>
<th>Source of Waste</th>
<th>Potential Cause</th>
<th>Waste Outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td>Design</td>
<td>Error in contract documents</td>
<td>Construction rework</td>
</tr>
<tr>
<td>Design</td>
<td>Contract documents incomplete at commencement of construction</td>
<td>Construction rework</td>
</tr>
<tr>
<td>Design</td>
<td>Changes to design during construction</td>
<td>Construction rework</td>
</tr>
<tr>
<td>Design</td>
<td>Choices about specifications of products or specified products not optimal</td>
<td>Construction rework</td>
</tr>
<tr>
<td>Design</td>
<td>Designer choice of low quality products with shorter life or resilience</td>
<td>Breakage, construction rework</td>
</tr>
<tr>
<td>Design</td>
<td>Lack of attention paid to sizes of products used</td>
<td>Ordering errors</td>
</tr>
<tr>
<td>Design</td>
<td>Designer not familiar with possibilities of different products</td>
<td>Less than optimal products used</td>
</tr>
<tr>
<td>Design</td>
<td>Lack of influence of contractors and lack of knowledge about construction</td>
<td>Construction rework</td>
</tr>
<tr>
<td>Procurement</td>
<td>Lack of consideration or budgeting and planning for waste management and disposal</td>
<td>Greater waste output</td>
</tr>
<tr>
<td>Procurement</td>
<td>Ordering error, over ordering, under ordering</td>
<td>Remainder product</td>
</tr>
<tr>
<td>Procurement</td>
<td>Lack of choice to order smaller quantities</td>
<td>Remainder product</td>
</tr>
<tr>
<td>Procurement</td>
<td>Purchase of materials which are unsuitable or unfit for purpose</td>
<td>Remainder product</td>
</tr>
<tr>
<td>Procurement</td>
<td>Supplier error – wrong materials supplied</td>
<td>Construction rework</td>
</tr>
<tr>
<td>Materials handling and logistics</td>
<td>Materials damaged during transportation</td>
<td>Damaged goods to waste</td>
</tr>
<tr>
<td>Materials handling and logistics</td>
<td>Inappropriate storage on site leading to damage or deterioration</td>
<td>Damaged goods to waste</td>
</tr>
<tr>
<td>Materials handling and logistics</td>
<td>Inappropriate packaging leading to damage of goods</td>
<td>Damaged goods to waste</td>
</tr>
<tr>
<td>Construction</td>
<td>Tradesman’s error</td>
<td>Damaged goods to waste</td>
</tr>
</tbody>
</table>
### Construction Waste Categories

<table>
<thead>
<tr>
<th>Category</th>
<th>Description</th>
<th>Fate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Construction</td>
<td>Equipment malfunction</td>
<td>Damaged goods to waste</td>
</tr>
<tr>
<td>Construction</td>
<td>Weather damage during construction eg storm, rain or hail damage</td>
<td>Damaged goods to waste</td>
</tr>
<tr>
<td>Construction</td>
<td>Accidental damage to materials</td>
<td>Damaged goods to waste</td>
</tr>
<tr>
<td>Construction</td>
<td>Damage to works caused by subsequent trades causing rework</td>
<td>Construction rework, damaged goods to waste</td>
</tr>
<tr>
<td>Construction</td>
<td>Use of incorrect material requiring rework and replacement</td>
<td>Construction rework, damaged goods to waste</td>
</tr>
<tr>
<td>Construction</td>
<td>Material quantities unknown due to planning error or inability to quantify at time of design</td>
<td>Over ordering, remainder product</td>
</tr>
<tr>
<td>Construction</td>
<td>Information about alternative types and sizes of products not available or provided too late</td>
<td>Less than optimal products used</td>
</tr>
<tr>
<td>Residual</td>
<td>Design requirement to cut uneconomical shapes eg tiles</td>
<td>Remainder product to waste</td>
</tr>
<tr>
<td>Residual</td>
<td>Standard lengths requiring cutting to required length eg timber</td>
<td>Remainder product to waste</td>
</tr>
<tr>
<td>Residual</td>
<td>Mixing errors in wet trades eg concrete, plaster</td>
<td>Remainder product to waste</td>
</tr>
<tr>
<td>Residual</td>
<td>Left over product from process eg concrete</td>
<td>Remainder product to waste</td>
</tr>
<tr>
<td>Residual</td>
<td>Excess packaging or packaging which cannot be recycled</td>
<td>Paper, cardboard, pallets, binding, plastic</td>
</tr>
<tr>
<td>Project Management</td>
<td>Lack of on-site control</td>
<td>Less than optimal production leading to waste</td>
</tr>
<tr>
<td>Project Management</td>
<td>Lack of consideration of waste management eg Waste Management Plans</td>
<td>Less than optimal production leading to waste and or no consideration of recycling</td>
</tr>
<tr>
<td>Other</td>
<td>Criminal damage, theft, breakage, graffiti</td>
<td>Damaged goods to waste</td>
</tr>
<tr>
<td>Other</td>
<td>Obsolescence, fashion trends</td>
<td>Rework</td>
</tr>
</tbody>
</table>


Clearly there are stakeholders who influence the level of C&D waste throughout the lifecycle of a residential building. Bossink and Brouwers (1996, pp56) argue that ‘prevention of construction waste is preferable to recycling of demolition waste at the end of the pipeline’ because it directly benefits most participants in the supply chain and because of the high degree of contamination and lack of homogeneity. This study predominantly looks at the end of the construction pipeline but does also make recommendations with respect to waste prevention at the beginning of the lifecycle of a building project. If the objective is to increase the level of recycling of building materials, then each of these causes must be addressed.

### 2.3 How much waste is generated by residential housing construction

A study by RMIT Centre for Design undertaken in April 2014 measured the C&D waste generated by the construction of two typical single storey 4 bedroom/2 bathroom brick-veneer houses constructed on concrete slabs with timber frames. These were chosen because they are the most common building methods and designs currently used in...
Australia with 45% of all houses built using this method followed by double brick at 25.7% and timber at 13%, fibre cement 6% and concrete/besser block 3.9% (ABS, 2006). In their study, the first house generated 9,126 kg of waste (bricks, mortar, roof tiles, and plasterboard). Various design and management strategies were then put in place by the builder to reduce the waste generated in the building process for the second house and a 99% reduction was achieved with a total waste to landfill from the second house of 30.8 kg. This means that between 30.8kg and 9,126kg of C&D waste is generated in new single dwelling home construction. However, considerable waste is also generated during renovation but the greatest quantities come during demolition of existing homes.

DECCW NSW (2010) has developed a house deconstruction guidance booklet to guide the industry. In that document DECCW NSW provides the following table of the typical composition of each common house type in Australia.

These figures will be highly relevant to the Capital Region Market as this type of building method is popular in this region as well. From the surveys of builders (four were multiple unit, multiple residence developers and the rest were smaller builders doing less than 20 projects per year) the smaller builders generated less than 10 tonnes per project per year on their estimation. This is in line with the RMIT Study. One builder from the Workshops commented that 9.1 tonnes per house ‘was a bit high’.

**Table 3: Typical composition of each house type (tonnes) Australia**

<table>
<thead>
<tr>
<th>Material</th>
<th>Asbestos fibro (tonnes)</th>
<th>Weatherboard (tonnes)</th>
<th>Brick veneer (tonnes)</th>
<th>Full brick (tonnes)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Asbestos sheeting</td>
<td>1.8</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Fittings</td>
<td>1</td>
<td>1</td>
<td>1.5</td>
<td>1.5</td>
</tr>
<tr>
<td>Roof tiles*</td>
<td>5</td>
<td>5</td>
<td>12</td>
<td>8</td>
</tr>
<tr>
<td>Plasterboard</td>
<td>2</td>
<td>2</td>
<td>2.5</td>
<td>1</td>
</tr>
<tr>
<td>Timber</td>
<td>5.3</td>
<td>7.2</td>
<td>9.6</td>
<td>6.9</td>
</tr>
<tr>
<td>Concrete, bricks, footings</td>
<td>20</td>
<td>50</td>
<td>120</td>
<td>180</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>35</strong></td>
<td><strong>65</strong></td>
<td><strong>146</strong></td>
<td><strong>197</strong></td>
</tr>
</tbody>
</table>

It should be noted that in the Capital Region, the trend to Colour bond roofing as a substitute for roof tiles is evident and this would change the tonnage. Other modern trends in building such as the use of blue board may also change these figures. Still, the modern house tends to be brick veneer or full brick. Older style homes are weatherboard and asbestos sheeting. It is interesting to note that the modern homes have more than five times the building material content of old homes.

A Western Australian study of the renovation of two homes (one 1850’s home) also provides a useful insight into the level of waste produced during renovation processes. The first house produced a total of 151 m³ the majority of which was described as ‘building rubble’ with small quantities of timber, reusable items and glass. However, a total of 50% of the waste was reused on site (limestone, timber and sand), 25% was recycled (roof tiles, concrete, bricks and sand) and 25% was disposed to landfill. In the second, asbestos was discovered however, even with this 55% of the material was recovered and only 45% was disposed to landfill due to contamination. Greater recovery was reported during the phase when the owner builder was slowly deconstructing (and sorting and separating) prior to the arrival of professionals to demolish the asbestos contaminated areas (Talis Consultants Pty Ltd, 2014).

2.4 WASTE MATERIAL CLASSIFICATIONS AND HIERARCHY
The 2007 the Department of Environment and Climate Change NSW produced a study of the C&D waste stream in the Sydney Metropolitan Area. That report classified waste into the following 18 categories:

Table 4: Categories of C&D Waste (DECC, NSW, 2007, pp4)

| 1. Asbestos and asbestos contaminated waste |
| 2. Contaminated soil                          |
| 3. Concrete products                         |
| 4. Soil                                      |
| 5. Timber                                    |
| 6. Fines                                     |
| 7. Clay Products                             |
| 8. Natural aggregates                        |
| 9. Garden and vegetation                      |
| 10. Ferrous metals                            |
| 11. Plasterboard                             |
| 12. Paper/cardboard                           |
| 13. Plastic                                  |
| 14. Textiles                                 |
| 15. Asphalt                                  |
| 16. Non-ferrous metal                         |
| 17. Glass                                    |
| 18. Miscellaneous                             |
Importantly, Figure 2 shows that the largest component of C&D waste was asbestos and asbestos contaminated material, followed by contaminated soil. Due to similar issues with asbestos products in homes in the Capital Region it is likely that asbestos contaminated material will apply to the region and apply for some time until the housing stock is renewed.

**Figure 2: Composition of C&D Waste Disposed to Landfill by weight, 2004-05**

![Composition of C&D Waste Disposed to Landfill by weight, 2004-05](source: DECC NSW 2007 pp8.)

**Figure 3: Composition of C&D Waste by Weight (All sites and with Garbage Bag Details)**

![Composition of C&D Waste by Weight (All sites and with Garbage Bag Details)](source: ACT Landfill Audits, Combined Final Audit Report for ACT NOWaste, July 2010, pp179.)
The ACT NOWaste Audit of 2010 provides a slightly different picture of the C&D material which is being disposed to landfill in the ACT.

It indicates that possibly a greater proportion of cement is being diverted but perhaps less brick and tile (clay products) and less plasterboard is being captured. Soil is an issue in both areas. Certainly the survey of residential builders indicated that the majority of them attempt to recycle concrete and are users of the by-product (crusher dust etc).

Strategies to address the problems with waste are now being developed based on a ‘waste hierarchy approach’. The waste hierarchy can be traced back to the 1970’s (Gertsakis and Lewis, 2003) and is concerned with the need to address waste along the full lifecycle of production rather than concentrating on end of pipe strategies. A 2003 study for Ecocycle Victoria by Gertsakis and Lewis, provided an interpretation of the hierarchy which has been adapted:

Table 5: Hierarchy of Waste Reduction

<table>
<thead>
<tr>
<th>Goal</th>
<th>Attribute</th>
<th>Outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td>Avoid</td>
<td>Preventative</td>
<td>Most desirable</td>
</tr>
<tr>
<td>Reduce</td>
<td>Preventative</td>
<td></td>
</tr>
<tr>
<td>Reduce at source</td>
<td>Preventative</td>
<td></td>
</tr>
<tr>
<td>Reuse</td>
<td>Predominantly ameliorative</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Part preventative</td>
<td></td>
</tr>
<tr>
<td>Recycle</td>
<td>Predominantly ameliorative</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Part preventative</td>
<td></td>
</tr>
<tr>
<td>Treatment</td>
<td>Predominantly assimilative</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Partially ameliorative</td>
<td></td>
</tr>
<tr>
<td>Disposal</td>
<td>Assimilative</td>
<td>Least desirable</td>
</tr>
</tbody>
</table>

Source: Adapted from Gertsakis and Lewis, 2003, pp7.

In terms of C&D waste this translates into the following action illustrated in the table below:

Table 6: Strategies to Reduce Waste

| Avoid:                      | Avoid waste in the design and procurement phases through encouraging design which minimises waste and makes it easier for deconstruction rather than demolition. |
|                            | Require planning to reuse deconstructed materials by minimising through use of modular components, selecting recycled and recyclable materials. Consider the use of materials which result in less waste or are more easily recycled. |
|                            | Avoid waste in the construction phase with care in relation to logistics, handling and processing. |

| Reuse:                      | Incorporate materials from the demolition and construction phases in the new building process. The Green Star program encourages this aspect for commercial buildings and should be applied to all building types. |

| Recycle:                    | Separate materials on site to enable ease of recycling and avoid |
2.5 **FOLLOWING THE LIFECYCLE OF C&D PRODUCTS**

A consideration of the causes of waste and the waste hierarchy leads to an examination of the lifecycle of residential home production. ‘Traditionally the use of construction materials is characterised by a linear process of extraction, manufacture, construction, maintenance and refurbishment, demolition, and disposal’ (Brennan et al, 2014, pp3). The lifecycle approach has led to considerations of a loop or cyclic production process. Brennan et al (2014) have compared Australian construction waste and demolition processes with that in Germany and the Netherlands and concluded that the Australian system has a long way to go. The report noted that in Australia around 57% of C&D waste was recycled in 2006-7, (NSW was higher than the national average at 67%) but Germany was 86% and the Netherlands virtually 100%. In 2013 Germany reported that 92% of C&D waste was now recycled (FMENCNS, 2012).

In June 2012, Germany brought into force a new Closed Cycle Management Act which aims to turn waste management into resource management. The legislation and accompanying policies adopt a closed cycle approach putting the responsibility for waste back on to manufacturers and distributors of products. Figure 4 below compares this closed loop system with the traditional linear model (FMENCNS, 2012).

**Figure 4: Linear and closed-loop model of C&D Waste**

![Figure 4: Linear and closed-loop model of C&D Waste](source.png)

Source: Brennan et al, 2014, pp3
Brennan et al (2014) also present comparative descriptive models of the Australian C&D waste recycling approach with the German approach which is focused more heavily on the reuse and recycle elements of the waste hierarchy than the Australian system as noted below in Figure 5.

**Figure 5: A Life Cycle Model of the Australian and German C&D Waste Recycling Approach**

Source: Brennan et al, 2014, pp4

Brennan et al (2014) note the stronger focus in Australia on disposal to landfill and explain this in the differences in legislation and pricing. The models are not necessarily an accurate reflection of the whole of the Australian C&D waste and recycling scene. A depiction of how C&D waste is dealt with in the Capital Region would put more emphasis on direct relationships between builders and landfill, consumers and landfill as they do their own renovations and demolishers and landfill when sorting is not a priority or not considered economic. In Australia there is a very weak relationship between suppliers of new products and the recycling industry in C&D. See Figure 6 below:

**Figure 6: Model of relationship of builders with other stakeholders in the Capital Region**

Source: Adapted from Brennan et al, 2014, pp4
There are pockets of excellence; however, the available data on volumes of waste to landfill provide strong confirmation that there is an issue with how this problem is being addressed.
CHAPTER 3.0 CURRENT STATUS OF CONSTRUCTION AND DEMOLITION WASTE IN THE ACT AND THE CAPITAL REGION OF NSW

3.1 CURRENT CONSTRUCTION & DEMOLITION (C&D) WASTE OUTPUTS: NATIONAL C&D WASTE DATA SUMMARY

A total of 19.0 million tonnes of construction and demolition (C&D) waste was generated in Australia in 2008-09 (DSEWPC, 2011, pp 45). Of this total waste stream, 8.5 million tonnes was disposed to landfill while 10.5 million tonnes, or 55%, was recovered and recycled (DSEWPC, 2011, pp 45). This is up from the 16.5 million tonnes of C&D waste estimated to be generated in Australia in 2006-7, although with an improved rate of recycling from 9.5 million tonnes (6.9 million tonnes landfilled) (EPHC, 2010).

In Australia, as noted previously the main ‘components of the C&D waste stream and the most commonly recycled materials, are concrete, bricks, asphalt, soil, timber and ferrous metals’ (EPHC, 2010, pp144). The reason for this is that these materials are usually demolished in larger quantities and therefore more cost effective for builders to recycle and there is a ready market for the product (EPHC, 2010).

Table 2 below shows the tonnes of C&D materials disposed and recovered in each Australian jurisdiction for 2008–09. The information is drawn from the Waste and Recycling in Australia 2011 report. It should be noted that information on the volume of waste and recycling contained in Waste and Recycling in Australia (DSEWPC, 2011) is based on an interpretation of government and industry data performed by Hyder Consulting. This includes publicly available reports and information sourced directly from industry. Data has been manipulated, where necessary, to better align the scope of material covered in each jurisdiction, and/or to provide source sector and material splits using national averages. In some cases, this produces results that are different to what is reported on by the jurisdictions themselves. The data should only be viewed as estimates and comparisons are difficult due to different measurement protocols in different jurisdictions.

Reliable and accurate data relating to material composition of the waste and recycling streams is simply not available in Australia, due to lack of data sets, definitional differences, inclusion of some items in different waste streams (Municipal and Commercial and Industrial) and measurement problems. In the Hyder report (DSEWPC, 2011), where jurisdiction-specific information was not available or was considered to be incomplete, estimates were based on national figures that drew on average composition data across those jurisdictions.
### Table 7: C&D materials recovered and disposed in each Australian jurisdiction for the 2008–09 financial year

<table>
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</tr>
</thead>
<tbody>
<tr>
<td>Masonry materials</td>
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<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Asphalt bricks</td>
<td>15,802</td>
<td>4,344,952</td>
<td>1,275,229</td>
<td>1,128,916</td>
<td>1,003,806</td>
<td>1,762,228</td>
<td>3,108</td>
<td>171,756</td>
<td>161</td>
<td>104,288</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Concrete</td>
<td>192,691</td>
<td></td>
<td>235,369</td>
<td></td>
<td>876,236</td>
<td></td>
<td>33,738</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other masonry</td>
<td>634,294</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Metals</td>
<td>28,637</td>
<td>419,986</td>
<td>33,884</td>
<td>109,122</td>
<td>26,662</td>
<td>118,906</td>
<td>24,324</td>
<td>88,363</td>
<td>4,913</td>
<td>79,203</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Organics</td>
<td>163,611</td>
<td>102,596</td>
<td>193,545</td>
<td>26,657</td>
<td>152,328</td>
<td>22,632</td>
<td>64,695</td>
<td>1,417</td>
<td>41,503</td>
<td>68,824</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Paper &amp; cardboard</td>
<td>13,079</td>
<td>874</td>
<td>15,480</td>
<td>227</td>
<td>12,177</td>
<td>-</td>
<td>9,906</td>
<td>76</td>
<td>2,364</td>
<td>585</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Plastics</td>
<td>14,298</td>
<td>3,253</td>
<td>16,923</td>
<td>845</td>
<td>13,312</td>
<td>2,380</td>
<td>9,494</td>
<td>352</td>
<td>2,537</td>
<td>277</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>other</td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Glass</td>
<td>2,294</td>
<td>207</td>
<td>2,723</td>
<td>54</td>
<td>9,865</td>
<td>84</td>
<td>3,726</td>
<td>6,861</td>
<td>1,210</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Leather &amp; textiles</td>
<td>10,596</td>
<td>-</td>
<td>12,543</td>
<td></td>
<td>4,962</td>
<td></td>
<td>4,308</td>
<td></td>
<td>117</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tyres &amp; other rubber</td>
<td>197</td>
<td>-</td>
<td>287</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>216</td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Hazardous</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Contaminated soil</td>
<td>313,269</td>
<td></td>
<td>370,576</td>
<td></td>
<td>291,665</td>
<td></td>
<td>7,022</td>
<td></td>
<td>55,068</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Asbestos</td>
<td>221,046</td>
<td></td>
<td>261,485</td>
<td></td>
<td>205,803</td>
<td></td>
<td></td>
<td></td>
<td>27,679</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TOTAL</td>
<td>1,845,183</td>
<td>4,871,868</td>
<td>2,182,674</td>
<td>1,717,938</td>
<td>1,906,230</td>
<td>2,059,749</td>
<td>3,108</td>
<td>171,756</td>
<td>161</td>
<td>104,288</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The composition data for material disposed in NSW, Queensland, Victoria, Tasmania and the ACT, as shown in Table 7, is based on average data drawn from South Australia, Western Australia, NSW and Victoria.

### 3.2 Current C&D waste data in the study region

Accurate and actual data on the C&D waste stream is even less readily available in the study region. Where data is available there are issues with different measurement, different categorisation of waste stream products, lack of capacity to measure accurately due to lack of weighbridges, estimation practices for mixed loads and staffing of waste management facilities. However, in 2011, the ACT Government and the South East Regional Organisation of Councils (SEROC) initiated a joint mapping study of waste in the Capital Region. Table 8 was devised using annualised volumes, composition rates and total estimated quantities by the researchers.

#### Table 8: Annual Construction and Demolition quantities – Capital Region

<table>
<thead>
<tr>
<th>Council Name</th>
<th>Annual Quantities Tonnes</th>
<th>Annual Landfilled Total Tonnes</th>
<th>Total Processed</th>
<th>Total Recoverable</th>
<th>Indicative size per capita</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bega Valley</td>
<td>26,731.87</td>
<td>13,365.94</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Bombala</td>
<td>78.00</td>
<td>78.00</td>
<td>-</td>
<td>-</td>
<td>0.03</td>
</tr>
<tr>
<td>Boorowa</td>
<td>1949.42</td>
<td>974.71</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Cooma-Monaro</td>
<td>3,765.00</td>
<td>1,882.50</td>
<td>-</td>
<td>-</td>
<td>0.36</td>
</tr>
<tr>
<td>Eurobodalla</td>
<td>5,058.75</td>
<td>2,504.56</td>
<td>11,785.91</td>
<td>398.60</td>
<td>0.13</td>
</tr>
<tr>
<td>Goulburn Mulwaree</td>
<td>14,064.62</td>
<td>7,032.31</td>
<td>14,064.62</td>
<td>-</td>
<td>0.49</td>
</tr>
<tr>
<td>Harden</td>
<td>2,889.57</td>
<td>1,444.79</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Palerang</td>
<td>9,300.00</td>
<td>4,650.00</td>
<td>-</td>
<td>-</td>
<td>0.63</td>
</tr>
<tr>
<td>Queanbeyan</td>
<td>32,741.14</td>
<td>16,370.57</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Snowy River</td>
<td>6,483.67</td>
<td>3,241.83</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Upper Lachlan</td>
<td>5,962.93</td>
<td>2,981.47</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Yass</td>
<td>12,134.79</td>
<td>6,067.39</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Young</td>
<td>493.00</td>
<td>246.50</td>
<td>-</td>
<td>-</td>
<td>0.04</td>
</tr>
<tr>
<td>ACT</td>
<td>277,397.28</td>
<td>138,698.64</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>399,050.04</strong></td>
<td><strong>199,539.21</strong></td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
</tbody>
</table>


These figures were confirmed through telephone and face to face interviews with waste managers in the Capital Region during this study. The ACT accounts for almost 70% of the region’s waste in terms of C&D material and this is understandable given that the level of residential development is highest within the Territory. “Building and construction comprises around 14 per cent of the region’s output value and around nine per cent of employment and is a significant
contributor to waste in the … region’ (SERRG, 2012, pp17). The data above in Table 8 indicates that only about 50% of the whole region’s C&D waste is recycled. Despite the data issues, this figure is likely to be more accurate given that the level of recycling of all waste in the rural and regional areas of NSW is estimated to be about 50% (NSW EPA, 2013, pp9). The individual percentage for the ACT alone is the same, 50%. However, the data from Table 7 indicates that this might be higher.

Notwithstanding this, these levels are nowhere near international best practice of greater than 90% (FMENCNS, 2012).

In July 2010 ACT NOWaste initiated an audit of the waste being landfilled at each of its sites. Around 6% of waste landfilled in the ACT each day was determined to be C&D material, including soil, timber, plasterboard, and bricks (Domestic and Commercial and Industrial Waste form the major components of waste). However, the study noted that C&D material could be classified as Commercial and Industrial Waste as well as Domestic where loads were unable to be identified or were mixed (ACT NOWaste, 2010), meaning that this figure could be significantly understated. Annual classified C&D waste to landfill was 38,900 tonnes in 2009-10 and 51,300 tonnes in 2010-11 (ACT NOWaste). In 2009-10, 246,777 tonnes of C&D demolition material was recycled (ACTNOWaste).

The practice in the ACT is for recyclable waste to be taken in mixed loads to the recycling centres and sorted there. In the regional local government areas, excepting Queanbeyan which disposes to the ACT facilities, various landfill sites operate with different capacities and policies regarding C&D materials.
CHAPTER 4.0: WHAT MATERIALS ARE SUITABLE FOR REUSE OR RECYCLING?

4.1 CHOICE OF MATERIALS FOR ANALYSIS
Using the lists developed by the NSW Department of Environment and Climate Change (2007) and the ACT NOWaste Landfill Audits (2010) discussed in Chapter 2 the following materials are examined in this study: concrete, soil, timber, brick and clay products, ferrous and non-ferrous metals, and plasterboard.

Other products such as asbestos and asbestos contaminated waste, contaminated soil, fines, natural aggregates, garden vegetation, asphalt, paper and cardboard, plastics and glass have been dealt with under a heading of ‘other’ below as they are already being addressed in terms of recycling, of lesser value in terms of recycling, cannot be recycled or are in smaller quantities or beyond the scope of this study.

4.2 CONCRETE PRODUCTS
The 2010 ACT Landfill Audit estimated concrete and cement disposed to landfill to comprise about 3.9% of all C&D waste collected at the three Mugga Lane facilities. The Recycler interviewed during the study reported that 20,000 tonnes of concrete had been recovered in the ACT in 2013-14 (with 3000 tonnes in stockpiles). The Sydney Audit (DECCNSW, 2007) puts the figure of concrete products disposed to landfill in that area at 16%. There is no data for the surrounding local government region. Given the level of recycling reported by the Recycler the ACT Landfill Audit figure is more appropriate to use as a rough estimate and assuming the same level of variables across the region (not entirely likely), applying 4% the total estimated C&D materials in the Capital Region provides a figure of 4,865 tonnes which could potentially be diverted from landfill. The figure could be higher.

Concrete recycling involves the use of crushing machines similar to those used for other materials such as rock and larger aggregate. The concrete is crushed into various levels of refinement. There is a strong market within the Capital Region for recycled concrete for road base and fill and for drainage lines as aggregate.

Crushed concrete can be used as a substitute for virgin aggregates such as gravel, limestone and rock. This product must comply with certain criteria and be suitable for specific applications if it is to be accepted in the recycled product market. Table 9 below summarises the suitability of RCA according to its classification. The classification system for recycled concrete aggregate (RCA) is based on nominal
material parameters including grading, impurity concentration and quality (Sagoe-Crentsil, 1997; see also Tam and Tam, 2006)).

**Table 9: Classification and Uses of RCA**

<table>
<thead>
<tr>
<th>RCA Classification</th>
<th>Bulk Fill</th>
<th>Drainage/Filter</th>
<th>Road Pavement</th>
<th>Pavement Concrete</th>
<th>Structural Concrete</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crushed demolition debris</td>
<td>Suitable</td>
<td>Usually suitable</td>
<td>Not suitable</td>
<td>Not suitable</td>
<td>Not suitable</td>
</tr>
<tr>
<td>Graded mixed debris</td>
<td>Suitable</td>
<td>Usually suitable</td>
<td>Suitable in some cases</td>
<td>Suitable in some cases</td>
<td>Not suitable</td>
</tr>
<tr>
<td>Clean graded brick/concrete</td>
<td>Highly suitable</td>
<td>Suitable</td>
<td>Usually suitable</td>
<td>Usually suitable</td>
<td>Suitable in some cases</td>
</tr>
<tr>
<td>Clean graded concrete</td>
<td>Highly suitable</td>
<td>Highly suitable</td>
<td>Suitable</td>
<td>Usually suitable</td>
<td>Potentially suitable</td>
</tr>
</tbody>
</table>


Note:¹ The use of RCA for an acoustic barrier has comparable suitability characteristics. See Krezel, 2002
² Suitable for sub-base, base, kerbs, car parks and footpath slabs.

Civil, commercial and residential works in the ACT seem to absorb as much reprocessed concrete and brick products as companies can produce. End-markets for concrete backing, sub-base, aggregate, crusher dust, brick dust, crushed brick, and whole bricks are well-developed. The main clients are private building contractors, civil and infrastructure contractors and wholesale landscape suppliers. The residential builders confirmed in the surveys that concrete is the most frequently recycled product and that they use recycled concrete in the building process. Sub-base, aggregate, and crusher dust sell for $12 - $16 per tonne, concrete backing sells for around $7 per tonne, and crushed brick commands a premium price at around $33 per tonne (for landscape applications).

Although gate fees for source-separated concrete and brick are far cheaper than landfill disposal costs (i.e. $5-$8 per tonne versus approximately $115 per tonne), there is reportedly some incidence of illegal dumping of concrete and brick by contractors on privately owned land. Therefore, cost savings are not always a major driver for waste generators to recycle this material in the ACT.

Higher rates of recycling could be achieved for concrete in particular if illegal dumping and stockpiling were addressed.
4.3 Soil

The ACT Landfill Report (2010) estimated soil to comprise 33.5% of C&D waste by weight going to its three facilities. In the region, only Eurobodalla Shire was able to report that about 80 tonnes of VENM was entering their landfills. The Sydney Metropolitan Area study (DECCNSW, 2007) estimates soil and contaminated soil at 8% and 21% respectively. If we assume that the ACT figures refer to contaminated and clean soil then the figures are roughly similar. If we do as before and use the ACT percentage across the waste totals (a little fraught in this instance as VENM was captured under C&I in the SEROC Study) however, the level appears to be significant. Using the C&I and not the C&D figures the level of soil to landfill in the Capital Region could be around 59,684 tonnes.

Soil and sand is generated from site preparation and excavation works associated with construction activities. Large volumes of fine materials are generated through these activities and, unless the material can be reused on site, it will require treatment, reuse, recycling and/or disposal. This includes soil and sand as well as other sub-4.75mm particles from mixed skip bin waste.

There is potential for the recovery of soil from landfill but also recognition that landfills require soil for operational purposes. As the ACT waste levy increases, the diversion of soil from landfill disposal is likely to increase substantially.

This material can be screened to produce a recycled soil for landscaping and the oversize material can be reprocessed to produce various qualities of general fill material.

Clean sand can be disposed at a recycling centre and does not usually require any further processing. Recycled sand can substitute virgin sand in a number of applications; however it is usually not suitable for high specification material applications such as brick-laying.

Soil is used in soil conditioners or mixed with organic material to improve soil structure in gardening and landscaping applications. The large C&D re-processors and traditional quarry companies recover this material.

Civil works contractors claim to at times be able to reuse the majority of excavated soil on-site. However, where there is excess and they are unable to reuse it on other sites there is now a problem of illegal stockpiling on privately owned land particularly in the NSW local government areas. ‘Clean fill’ attracts a sale price of $0 to $5 per tonne, whereas ‘soil’ (VENM) is sold for around $10 per tonne in ACT.

Although re-processors had limited comments at the Workshops and in Interviews on issues around soil recovery, regulators and the construction industry
representatives identified soil as an area of increasing concern. The landfill operators often require soil for capping landfill, but when this is not required they will close the landfill to acceptance of soil. This presents a disposal problem for the industry. Workshop attendees reported using their networks to find other contractors who required soil or keeping several projects going so that soil can be transferred and spread across all of the projects. Many contractors reported the need to construct structures on development sites as a method of disposing of soil. Soil was reported at all workshops as an issue.

Once soil is mixed with general C&D waste it easily becomes contaminated, which limits options for beneficial reuse. A large quantity of soil is recovered during sorting of mixed C&D, but it can only be classed as VENM if stringent sampling standards are applied. Re-processors generally find the cost of sampling to be excessive, and will on-sell as ‘fill’ material for limited applications. One ACT regulatory respondent believed there needed to be a system established to correctly assess the risk of contamination and ensure that soil resulting from the sorting process could be beneficially reused without the need for excessive sampling.

In NSW, gate fees ranged from $0 tonne for certified Virgin Excavated Natural Material (VENM) when it is needed and $131 tonne when not or for non-certified excavated soils. It was highlighted in the Workshops, however, that there did appear to be growing insistence on certification being produced before material was accepted at recycling facilities or reuse sites.

4.3.1 Contaminated soils
Contaminated soil disposed to landfill is soil with contaminants at typical levels considered to be either ‘solid’ or ‘industrial’ waste according to the NSW Environmental Guidelines: Assessment, Classification and Management of Liquid and Non-Liquid Wastes (2004), as well as soil that has not been properly characterised.

It is not possible to get any figures on the amount of contaminated soil in the Capital Region. This material is currently disposed to landfill (see above discussion on soil). Quantities are expected generally to decrease over the long term as improved treatment technologies are introduced along with methods of on-site reuse of material so to avoid the generation of waste altogether. The opportunity for environmentally appropriate resource recovery of contaminated soil is limited by technical, market and economic barriers.

In NSW, landfill gate fees range from $10 to $99 tonne for non-certified excavated soils and rubble that meet the environmental regulator’s acceptance criteria
(essentially it depends on the make-up of the material). This information was reported during the Telephone Interviews. There are significant testing requirements involved in meeting the environmental regulator’s standards for VENM or for Excavated Natural Material (ENM) to gain a Resource Recovery Exemption so that it can legally be applied to land. One low-volume processor (handling less than 10,000 tonnes of this material per annum) told Hyder the compliance burden was so high ‘it’s almost better off to landfill it’ (DECCNSW, 2007). This organisation claimed the operational cost of testing and processing material is around $75/tonne, with the majority of that cost associated with the need for landfill disposal of around 70% of the material processed.

This operator claimed the cost of complying with contamination testing requirements for material from individual sites made it more economical to landfill excavated material unless at least 30-40 tonnes were generated through an individual project.

### 4.4 Timber

The ACT Landfill audit shows that around 12% of C&D material is timber. Applying this ratio across the Capital Region indicates that around 12,164 tonnes of timber material is currently being landfilled. One local government area reported by telephone interview taking approximately 600 tonnes of timber with only 100 tonnes being able to be recovered per annum.

Timber can be reclaimed, reused, or re-processed into flooring or horticultural mulch (where permitted under local regulations). It includes hard wood, softwood, plywood, medium-density fibreboard and particleboard. Most timber is generated from the demolition sector. Recovery depends on several factors – size, type, condition and treatment or paint.

Timber tends to range in size from:

- large size (>300mm) pieces of timber
- medium size (30-300mm) pieces of timber.

Timber has the potential for increased recovery from landfill disposal but potential barriers include the physical handling of large pieces of timber, sorting the small proportion of timber contaminated with copper, chromium and arsenic, lead-based paint and nails; the increasing mechanisation of demolition works (primarily due to time pressures and work health safety requirements on site) which makes it more difficult for salvage operations to take place, and increases the potential for high value timbers to be damaged.
A significant source of salvageable hardwood is ‘infrastructure timber’ such as power poles and railway sleepers, for which there is strong demand for use in landscaping applications.

Lighter mixed woods are currently shredded and used as mulch in landscaping or if unsuitable for this purpose used as cover in landfill sites. Contamination of raw timber with treated timbers and engineered wood products is considered a barrier to increasing reuse.

A potentially significant market being developed for recycled timber is as use in animal bedding, especially for poultry. However the market potential for this depends upon proximity of the poultry growers and scale economies of production of the material.

Other barriers to recovery of C&D wood waste include the large supply of materials that compete in the marketplace with recovered wood waste (such as sawdust and off-cuts from the state’s forestry operations). These products are relatively cheap.

There is limited recovery of reusable hardwood for resale. However, there are at least three businesses in the Capital region recycling timber; and at least six recycling into mulch, particleboard, animal bedding and or bioenergy.

4.5 Brick and Clay Products (Bricks and Tiles)
This is considered primarily to be brick and tile-related products. This material is recovered from building and demolition works. These can be reclaimed (salvaged) whole for resale, or crushed to be used as raw material for re-firing into bricks or used as landscaping material, general fill, drainage, road pavement, structural concrete or pavement concrete. There is a very established market in the Capital Region for crushed brick products and in the surveys the residential builders reported that they did recycle some of this product. Bricks and tiles were the second highest recycled product reported.

4.6 Ferrous and Non-ferrous Metals
There is a strong market for recycling of metal in the Capital Region with builders, skip operators and demolition contractors reporting that separating metal is economical. Metals are categorised as either ferrous or non-ferrous. Ferrous metals being those metals that contain iron (steel scrap, stainless steel, steel cans, alloy scrap, tinplate, cast iron), whilst non-ferrous metals are those void of any iron (aluminium, nickel, brass, copper, lead, metal ash, precious metals, tin, zinc).
The majority of metals recovered from the C&D sector are from demolition sites (industry estimates place this at about 90%), however residential builders in the Capital Region reported high levels of recycling of metal. Of this material, the vast majority is steel, and the remaining materials are non-ferrous metals. This non-ferrous component mostly includes aluminium (1 to 2%), stainless steel, and copper piping or wire.

Metals coming from the C&D sector are also sourced from concrete reinforced with steel (known as reo).

Scrap metal prices are subject to international forces and during the Global Financial Crisis there were reports of serious disruptions to the market for recovered scrap. While the price re-processors will pay for mixed scrap is highly variable (and generally one of the industry’s most carefully guarded secrets), the current ballpark figure is around $250/tonne. Coupled with the value of avoided landfill disposal costs, there is a strong economic incentive to recover this material stream.

SEROC’s 2013 Waste Stream Mapping Report estimated a total of 18,185 tonnes of metal are presented to landfill sites in the Capital Region. Due to the value of scrap metal, it is usually separated from other materials and put aside at local landfills, ready for collection once there is a sufficient stockpile for recovery. This is generally the case across all of NSW.

Re-processors in the ACT do not generally charge gate fees for source-separated metal waste, which is on-sold to a scrap metal merchant. Metal is sorted from mixed-loads using both manual techniques and magnets (for ferrous metals). Since metal is a relatively valuable commodity, negligible amounts are sent to landfill. The survey of builders put metal as the third most recycled product.

4.7 Plasterboard

Plasterboard is considered a contaminant when mixed in C&D materials as it makes it difficult to recover especially in mixed C&D loads, even though plasterboard itself is highly recyclable (DSEWPC (2012). The ACT Landfill Audit (2010) indicated that 9% of C&D waste was comprised of plasterboard. If this percentage is applied across the region it indicates a potential 10,948 tonnes of plasterboard may be being landfilled in the region per annum.

There is a ready market for recycled plasterboard in the form of gypsum for soil conditioner in agricultural applications, however if as noted above it is not separated, recovery is difficult.
Other research shows that plasterboard can be collected, with contamination removed, and recycled into new reprocessed plasterboard.

There are advantages to recycling gypsum as it causes problems in landfills with its potential to impact on the structural integrity of clay liners.

All asbestos and asbestos contaminated material in Australia is landfilled. Programs across some States and territories are requiring that asbestos material is dealt with under strict handling protocols and buried in special landfill centres and the location recorded for future reference.

Fines are defined as the material from mixed C&D waste (glass, soil, brick, sand etc) that is less than 4.75mm in size. There are considerable barriers to recycling fines including screening for contamination.

There is a well-established recycling process and market for asphalt, paper and cardboard, plastics and glass in Australia and the Capital Region. For the regional local governments, the problem is the lack of quantities which are viable for recycling and lack of ability to stockpile in terms of regulation requirements and land availability.
5.0 Barriers to avoiding, reducing, and recycling C&D waste

5.1 Overview
The previous chapter indicated that there is considerable potential to harvest greater amounts of C&D materials currently being landfilled in the Capital Region by recycling, reuse or remanufacturing. However, there are barriers to this happening. In the Workshop discussions in this study the following issues were raised by the facilitators as issues with C&D waste:

- Lack of actual data on the volume and composition of C&D waste particularly in the regional areas – no weighbridges
- Variable regulations, fees, management between local government areas
- Disposal location ‘shopping’ (finding the cheapest place to dispose of material)
- Illegal dumping
- Lack of suitable sites especially for soil disposal
- Lack of facilities for recycling.

The following barriers were also suggested to the groups in the discussions by the facilitators:

- Habit
- Not enough space on the work site
- Cost of sorting – lack of financial incentive
- Time to sort on site
- Lack of facilities
- Lack of knowledge
- Planning requirements
- Specifications/standards for products
- Cost – disposal fees
- No demand for sorted materials or no place to take them
- Care factor

These factors were presented to encourage the attendees to consider the barriers to greater recycling in their region. They were provided from anecdotal evidence provided by the study proponents and from the results of the literature review. As noted below, some of them were considered relevant and others not.
5.2 Barriers identified from the literature review
The literature indicates that there are numerous barriers hindering construction waste reduction, reuse and recycling. These were identified as:

1. Lack of knowledge about what can be recycled or what recycling opportunities exist within the region
2. Contamination of recyclables due to lack of separation
3. Lack of markets/lack of demand for the recycled materials
4. Technological barriers in terms of conversion of waste materials to useful ends
5. Cost of recycling processes making products more expensive than that from virgin materials
6. Design for deconstruction has not yet been incorporated into the building process
7. Alternatives to recycling are less costly – landfill gate prices are too low
8. Government policy is not driving recycling
9. Lack of confidence in recycled materials
10. Lack of communication and industry infrastructure
11. Lack of knowledge across industry and requirement for training
12. Low value products/low volume products being landfilled rather than stored for recycling because it is uneconomic to stockpile.

5.3 Barriers identified from the workshops and telephone interviews
The five workshops identified similar barriers across the region to the reuse and recycling of C&D material. There are however, a few additional local barriers which were not revealed by the literature review. In addition, some of the barriers identified in the literature were not considered by the local stakeholders as important as barriers. Table 10 below summarises the barriers identified in the literature and the workshops. Where there is commonality between the two they are indicated by blue shading.
<table>
<thead>
<tr>
<th>Barriers identified by the literature</th>
<th>Barriers confirmed by Local Stakeholders</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lack of knowledge about what can be recycled or what recycling opportunities exist within the region</td>
<td>Interview</td>
</tr>
<tr>
<td>Contamination of recyclables due to lack of separation</td>
<td>Interview</td>
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<tr>
<td>Lack of markets/lack of demand for the recycled materials</td>
<td>Interview</td>
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<tr>
<td>Technological barriers in terms of conversion of waste materials to useful ends</td>
<td>Interview</td>
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<tr>
<td>Cost of recycling processes making products more expensive than that from virgin materials</td>
<td>Interview</td>
</tr>
<tr>
<td>Design for deconstruction has not yet been incorporated into the building process</td>
<td>Interview</td>
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<tr>
<td>Alternatives to recycling are less costly – landfill gate prices are too low</td>
<td>Interview</td>
</tr>
<tr>
<td>Government policy is not driving recycling</td>
<td>Interview</td>
</tr>
<tr>
<td>Lack of confidence in recycled materials</td>
<td>Interview</td>
</tr>
<tr>
<td>Lack of information re industry infrastructure</td>
<td>Interview</td>
</tr>
<tr>
<td>Lack of knowledge across industry and requirement for training</td>
<td>Interview</td>
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<tr>
<td>Low value products/low volume products being landfilled rather than stored for recycling because it is uneconomic to stockpile</td>
<td>Interview</td>
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<tr>
<td>Additional Barriers identified in the Workshops</td>
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<tr>
<td>C&amp;D material is not considered as a potential resource (except metal)</td>
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<tr>
<td>Environmental regulations are working against recycling</td>
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<tr>
<td>Lack of facilities for recycling</td>
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<tr>
<td>Inconvenience of location of recycling facilities or need to take materials to many different places</td>
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<tr>
<td>Material specification in buildings not encouraging recycling</td>
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<tr>
<td>Lack of facilities to store soil particularly VENM for reuse later</td>
<td></td>
</tr>
<tr>
<td>Different budget and management structures between jurisdictions preventing cooperation in certain areas</td>
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</tbody>
</table>
As indicated in Table 10 the most important barriers to recycling and reuse in the Capital region are:

1. Lack of knowledge about what can be recycled or what recycling opportunities exist within the region
2. Contamination of recyclables due to lack of separation
3. Alternatives to recycling are less costly – landfill gate prices are too low
4. Government policy is not driving recycling
5. Lack of information regarding industry infrastructure
6. Lack of knowledge across industry and requirement for training
7. Low value products/low volume products being landfilled rather than stored for recycling because it is uneconomic to stockpile
8. C&D material is not considered as a potential resource (except metal)
9. Environmental regulations are working against recycling
10. Lack of facilities for recycling
11. Inconvenience of location of recycling facilities or need to take materials to many different places
12. Material specification in buildings not encouraging recycling
13. Lack of facilities to store soil particularly VENM for reuse later and
14. Different budget and management structures between jurisdictions preventing cooperation in certain areas.

Because the attendees are stakeholders from the end of the construction pipeline, they tended not to consider issues which might be barriers through the full lifecycle. When raised as potential barriers during the workshops, issues such as efficient design, product wrapping and take-back facilities were recognised and considered as potential barriers but less important to this group.

**1. Lack of knowledge about recyclables and facilities in the region**

There appears to be a lack of information and knowledge across the board in the region about what can be recycled, where it can be taken to, how much that will cost, opening hours and so forth. Discussion also included the need for information regarding what each facility is able to take. Distances to recycling facilities are an issue for the industry. Where landfill is closer, it may be economic for them to dispose rather than to attempt to recycle. Builders are generally aware that there are recycled products available, but they do not appear keen to use them in preference to virgin materials.

**2. Contamination**

The landfill managers and operators were very concerned about contamination of loads of materials and the need to landfill loads which could not be readily identified. They expressed a strong wish for sorting of C&D waste at the source

“Customers hide materials to avoid payment. Customers need educating on what is and isn’t recyclable.”

“People are changing their kitchens every 5 years!”
not at the waste facility. However, it should be noted that the model adopted by the ACT is to sort at the recycling facility. Despite this, the ACT recycler representative noted that if builders were to sort C&D materials prior to depositing at the recycling centre, their sorting facilities would be able to recover far more material.

Other issues such as government procurement not stipulating recycled materials were raised with Workshop participants. They agreed that in general this is the case excepting perhaps use of recycled crushed concrete and sometimes recycled asphalt. There was agreement that more could be done if government led the way in terms of procurement.

3. Landfilling is cheaper than recycling costs

All workshop attendees considered that there is no price incentive to recycle C&D materials. Most workshop attendees compared the landfill gate fees which they pay locally with those in metropolitan Sydney and considered that theirs was too low to incentivise recycling.

3. Government policy

Due to the complexity of State, Territory and local government regulations covering waste management and environmental matters in the region, stakeholders considered that different government agencies were working against recycling efforts as they seem to have different objectives.

5. Communication re infrastructure

In order to secure co-operation and engagement from the industry on implementing waste reduction and recycling practices, there needs to be a high level of awareness and knowledge of these issues among industry practitioners together with information and help to facilitate waste minimisation and recycling practices. This is not the case across the industry. Some stakeholders are well informed. Most are not. Any communication program must include the entire industry supply chain and other stakeholders that have an influence on waste management practices. Key stakeholders include:

- Manufacturers
- Suppliers
- Designers
- Engineers
- Consultants
- Government Procurement Department representatives
- Local and State/Territory Government representatives
• Councillors
• Builders
• Sub-contractors
• Waste Management Companies.

5. Requirement for training across industry

Many of the attendees raised concerns regarding not only the training of people working in the building and construction industry about how to avoid waste as well as recycle but also those managing waste facilities. A number of workshop participants expressed deep concern about the management of some facilities and that the personnel there were not regarded as professionals although they should be and need to be considering the materials that are entering these facilities. They also expressed concern about work health and safety at these facilities.

6. Low value uneconomic volumes of material

One of the main difficulties in establishing markets for recycled-content aggregate is the low cost of virgin aggregate. The price differential between recycled materials and virgin raw materials is currently insignificant. This is because the cost of separating and reprocessing build product materials must be incorporated into the product price for a recycling operation to remain economically viable. Therefore with no or little price differential there is no economic driver for building product consumers to change their habits and start to use recycled materials. Coupled with low volumes of material to process (unless collected over a long period of time – there are environmental issues associated with this), land fill managers are faced with the dilemma of losses to process small amounts of landfilling the small amounts of material.

7. C&D is not important or not considered a resource

It was fairly clear from the local government and ACT waste managers that C&D is not a priority for them. Due to volumes, Commercial and Industrial and Domestic Waste are their greatest priority. If the industry wishes to advance recycling it will need to promote this as a priority with the government managers.

8. Environmental regulations

Many expressed the view that environmental regulations are working against recycling of C&D product, specifically preventing stockpiling for processing. In addition all Workshops admitted that the Waste Management Plans currently being required by Planning Departments of governments are not being audited or
checked by regulators to see if they have been followed. The exception is perhaps the location of garbage collection areas in multi-unit developments. Otherwise this system does not seem to be effective. It is possible that this is due to the administrative burden required to police compliance with the requirement.

9. Lack of facilities

In many of the local government areas in the Capital Region, the level of waste is small therefore there is a lack of facilities to process and recycled C&D content. The only alternative is to stockpile until economic quantities are reached and then either transport it to a facility or bring in transportable processors. The environmental regulations are working against this.

10. Inconvenience of locations

The Workshop participants cited location of facilities as a factor in the economics of recycling for them. Where recycling facilities were inconveniently located, requiring them to transport waste further than the landfill, that mitigated against considerations of attempting to recycle, especially if the fees did not incentivize them.

11. Material specification not encouraging recycling

A number of the builders who attended the workshops raised concerns with building specifications and the problems with getting materials specified as being suitable for reuse. They believed that this encouraged the use of virgin materials. One participant suggested the need for a star rating or similar for residential buildings which encourages recycling.

13. Soil Stockpiling facilities

This was one of the major issues raised in the larger more populated areas with greater building activity. As noted in Chapter 4 soil and soil reuse and disposal is of concern to builders. They are currently using informal networks to try and dispose of soil but they report a high level of dumping. Regulatory barriers to soil stockpile sites appear to be a high priority concern.

14. Different budget and management structures between jurisdictions preventing cooperation in certain areas

When local government landfill operators and managers were asked about their ability to cooperate in terms of fee structures and provision of shared facilities they noted that they are required to operate their facilities within certain budget
outcomes which are different for each local government area. They noted that they currently do cooperate on certain aspects and are willing to engage in greater collaboration if the budgetary issues could be solved.

The Workshops and Telephone and Face-to-face interviews indicated significant barriers to increasing recycling in the Capital Region. However, there was strong enthusiasm and support from all parties to do so and all nominated various opportunities and willingness to improve the level of recycling of C&D material.
CHAPTER 6.0 OPPORTUNITIES AND STRATEGIES TO ENCOURAGE GREATER REUSE AND RECYCLING OF C&D WASTE IN THE ACT AND CAPITAL REGION OF NSW

6.1 OVERVIEW
The literature provides a range of strategies to improve the level of recycling in the building and construction industry. The strategies were tested in the Workshops and the Interviews in terms of their industry acceptance and practicality. The following strategies were discussed with the Workshop attendees:

1. Non-acceptance of over-deliveries – addressing culture of oversupply
2. Take back of recyclable waste by suppliers eg part pallets of bricks, tiles
3. Regulation to minimise packaging or take back of packaging
4. Regulation to require sorting
5. Waste Management Plans mandatory – client/home owner or contractor or client/home owner waste disposal form
6. On site waste sorting and site clean-up possibly by third party – social enterprise
7. Information for builders and consumers about better product choices eg colour bond roofing versus concrete roof tiles
8. Education for builders on better design
9. Education for builders and home owners re recycling opportunities/regulations
10. Fee differentials for various categories of waste
11. Social ventures to be involved in sorting and or recycling
12. Council/government procurement policy to give priority to recycled product – 10% price advantage to recycled products
13. Close uneconomic tip sites and change to waste transfer stations
14. Development of a waste brokerage industry
15. Tip sites for soil spoil
16. Tips around the region to specialise in particular types of waste to allow industry to grow up around it.
17. Councils and ACT Government to advertise/campaign to reduce waste in order to ensure support for it.

Notwithstanding the above list, the Workshops and Telephone interviews and Questionnaires revealed a different list of strategies and priorities for the stakeholders.
6.2 Opportunities and strategies to reduce C&D waste in the Capital Region

The strategies identified in this study were categorised and summarised as shown in Table 11 below. The table also indicates which group was most in favour of this type of action. However, overall there was general consensus with respect to the strategies.

Table 11: Strategies to Reduce C&D Waste identified for the Capital Region by Industry Stakeholders

<table>
<thead>
<tr>
<th>Strategy/Opportunity Group</th>
<th>Specific Strategies</th>
<th>Proposed by</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Education and Training</td>
<td>a. Education and training of builders and designers (agreement across all workshops)</td>
<td>All</td>
</tr>
<tr>
<td></td>
<td>b. Education and training of waste management facility operators</td>
<td>All</td>
</tr>
<tr>
<td></td>
<td>c. Education and training for government procurement people</td>
<td>All</td>
</tr>
<tr>
<td>2. Media and Information campaigns</td>
<td>a. Targeted media for the public to inform them about possibilities and to create demand</td>
<td>All</td>
</tr>
<tr>
<td>3. Materials research</td>
<td>a. More scientific research into what to do with certain materials in the Australian context</td>
<td>Landfill managers</td>
</tr>
<tr>
<td>4. Materials specifications</td>
<td>a. Examination of specifications for building which allows for recycled materials use</td>
<td>Builders</td>
</tr>
<tr>
<td>5. Procurement</td>
<td>a. Procurement incentives eg 10% leeway on recycled materials in government contracts (Canberra workshop)</td>
<td>Builders</td>
</tr>
<tr>
<td>6. Regulation</td>
<td>a. Enforcing WMPs or scrapping them especially for residential building</td>
<td>Builders/all</td>
</tr>
<tr>
<td></td>
<td>b. Regulation to force builders to separate and recycle certain materials</td>
<td>Waste management operators, some builders and recyclers</td>
</tr>
<tr>
<td></td>
<td>c. Regulation at state and Commonwealth level should be introduced for manufacturers to take back product and packaging and for rating its recyclability. Encouraging the Packaging Covenant.</td>
<td>All</td>
</tr>
<tr>
<td>7. Fees and charges</td>
<td>a. Fee differential incentives to separate/sort recyclable materials from non-recyclables (all workshops)</td>
<td>All</td>
</tr>
<tr>
<td>---------------------</td>
<td>-------------------------------------------------------------------------------------------------</td>
<td>-----</td>
</tr>
</tbody>
</table>
| 8. Industry support and business development | a. Support for businesses/companies for recycling and reusing e.g. an industry support scheme (Yass workshop)  
   b. Onsite sorting services provided by third parties to create a business opportunity and or social enterprise. Builders sponsor social enterprises to clean up sites  
   c. Encouragement of a business of Waste brokers as in Europe (Queanbeyan workshop)  
   d. Developing a star rating system for residential homes similar to the commercial sector which includes use of recycled materials. | Recyclers  
   All  
   All  
   Demolition contractors |
| 9. Planning of new developments to allow Recycling areas | a. In the ACT for example, the Land Development Authority (LDA) dedicating temporary parcels of land for waste material storage for building sites. Fenced-off for security reasons the site should also be managed (Canberra workshop). This could also be replicated in other Capital region areas. | Builders |
| 10. Prevent cherry-picking of recyclables | a. Stop allowing cherry picking of recyclables (Queanbeyan workshop) or in other words, make recycling easier by having one stop shops. | Builders |
| 11. Manning and professionalisation of tips and landfills | a. Ensure all landfill sites are professionally manned and operated (Queanbeyan and Young workshops) | Builders |
| 12. Information | a. An information App and mapping exercise to identify waste and recycling facilities. This would have to be maintained as a service. This could be generated by say the MBA as a Members’ Services alert made available on their website (Canberra workshop, see also below)  
   b. An information APP which brings together buyers/builders who need soil and those who have soil and need to dispose of it. This need not | All  
   Builders |
6.2.1 Training

Training of industry stakeholders was also important to all. The development of courses for builders and apprentices on waste and recycling, legislation covering waste and alternative materials and building methods which reduce waste was considered vital if the industry was going to change its culture. Participants recognized that younger builders were more aware however; even they lacked complete information about what could be done.

Training for waste management operators to raise awareness and their management capacity was also given a high priority especially by builders and waste managers. Ability to recognise materials and manage a professional and safe site depends upon the staff being well trained.

Waste management education and communication will be central to any initiatives, program or targets established to promote the safe disposal and recycling of building product wastes. Without a dedicated and coordinated communication, education and implementation program, with demanding but achievable targets and appropriate resources and funding, any measures that are implemented will be far less effective.

The role of this measure would include the engagement of stakeholders and co-ordination with industry bodies and associations to develop partnership programs. This measure’s purpose would include developing links between the industry and the implementation program team and provide a forum for the stakeholders to provide feedback relating to the development of the program. Ultimately, the objective would be for the industry and stakeholders to embrace and have ownership of the overall objective, which is to provide safe disposal, increased recycling and sustainable development with in the construction and building industry.

6.2.2 Media and Information Campaigns

The 2011 Waste and Recycling in Australia Report noted that successful implementation of landfill management changes require building ‘an understanding of where waste could be diverted. Understanding of the alternative
avenue of treatment usually improved support for landfill bans and the development of regulations and associated programs’ (Hyder, 2011, pp145). The ACT and surrounding local governments could collaborate and play an enhanced role in disseminating information regarding recycling practices and the use of recycled product. This study revealed that there not only needs to be a change in culture and perceptions about building and construction waste particularly as a resource rather than just waste and as something which needs to be prevented or limited; but also more general information about what can be done.

This could take several forms including:

- General media advertising to the public on the need for C&D recycling and anti-dumping to reach a broad audience; and
- Information about recycling facilities, locations, opening hours.

The Western Australian Master Builders Association has produced a “Smart Waste Guide” (April 2014). This kind of document could be adapted to local conditions and information and provided here, particularly in concert with the new policy documents being produced by the ACT MBA. The local government areas already do a lot of educational activity with schools, however, this is not targeted at this type of activity nor would it be appropriate or effective. Other educational programs for the industry participants and the public should be developed to complement these existing resources and these could easily be part of collaboration within the region.

6.2.3 Materials Research
Some stakeholders but particularly the landfill managers expressed a concern that there is a lack of knowledge about what can be done with certain materials, and, in the absence of this knowledge, the default position is to landfill or dispose of materials which might otherwise have value. There is a need for more work to be done to examine the techniques and strategies used by other international jurisdictions to reduce waste and perhaps new scientific research.

6.2.4 Material Specifications
Not only did the builders consider there was a need for a specifications course designed to help project managers and builders understand the specifications of new materials such as recycled aggregates and substitute materials, and to learn how to incorporate them into projects; but they also considered there needed to be more development of existing specifications to allow for greater use of recycled product.
6.2.5 PROCUREMENT

Some stakeholders, namely larger builders who tend to do business with government through the development of public housing or commercial works felt that government could do more in terms of leadership through their procurement and stipulating recycled content or giving a preference weighting to recycled content in tenders for public housing. Another way would be to address it through pre-qualification requiring contractors who deal with government to have Waste Management Policies and programs in place and demonstrated compliance.

6.2.6 REGULATION (Reducing Green Tape and Requiring Pre-sorting)

Waste Management Plans (WMPs) seem to be required throughout the region however; in general these are not audited at the end point. It seems for the residential building industry the benefits lie in initially making builders think about waste and recycling and in planning with respect to location of waste bins in multi-residential sites. There is a cost to government to audit and enforce the WMPs and it might be prudent for governments to review the effectiveness of these plans.

Regulation of the compulsory separation of all main waste streams during any construction or demolition process and non-acceptance of recyclable materials at waste disposal centres (except contaminated waste) was an important strategy considered during the study. Most were in favour of this approach. The Waste and Recycling in Australia 2011 Report (Hyder) also points out that a condition of pre-sorting has delivered positive results elsewhere.

Green waste is already frequently collected separately for recycling, showing that separate waste streams can be removed from demolition sites. The categories for each waste type could be:

- Hazardous / Biodegradable (excluding Green waste)
- Green waste
- Bricks and Tiles
- Concrete (Base, pathways, foundations)
- Metals
- Timber
- Plasterboard.

Remaining materials such as fines, glass and plastic could also be recycled but may not be required to be so due to volumes. These categories would have to be established in consultation with the industry and skip operators.

The take-back of unused but good quality product (left over tiles, bricks and plasterboard) was considered a good idea, but not so important or necessarily
practical. Most however, considered it a good idea to reduce packaging and require reduction or take-back of packaging. This was recognized as an issue which may not be able to be dealt with at the local or regional level.

6.2.7 FEES AND CHARGES

Along with information and training and soil disposal, fees and charges were of most concern to stakeholders. Interestingly, the builders, recyclers and demolition contractors all felt that the fees were too low for disposal to landfill. They advocate a system of incentivizing builders to recycle by charging them far less to recycle and sort than is done for disposal to landfill. They warned against making fees too high and encouraging illegal dumping, however they felt that much could be done in this area. A number of the waste managers noted that where there was a large fee differential between waste facilities located close by, there would be a problem of disposal shopping. This would have to be addressed by the local government areas coordinating their fee structures to prevent this type of activity.

The 2011 Hyder Report concluded that C&D waste generation responds most rapidly to a pricing signal (compared to C&I and Municipal Solid Waste). Figure 7 below from the report shows a marked change in proportions of material landfilled as prices per tonne increase.

Figure 7: An Estimate of Responses to the Increase in Price of Landfill for Certain Waste Streams

6.2.8 Industry Support and Business Development

A number of ideas were raised in the successive workshops which could be described as business development opportunities. For example, one recycler told of the difficulty that his firm went through in establishing the business early on. He believed that he could have benefitted by a low interest loan scheme or similar to assist him to get started.

Businesses doing on-site sorting (one participant noted that he performed this service in Sydney but had not offered it locally) were raised as a potential way of encouraging greater recycling. It was noted that this could be a suitable activity for social enterprises.

Waste brokerage was also discussed as a potential business venture which could be developed in the region.

A demolition contractor suggested that as the star rating for commercial buildings now encourages recycling, then the development of a like star rating for residential buildings could also work the same way.

6.2.9 Planning of New Residential Developments to Allow Recycling Areas

At a number of the workshops, it was suggested that where new housing development is being undertaken, the planning approvals should allow a site to be set aside for the builders to recycle materials and for recyclers to collect the materials at regular intervals. This would be beneficial to both parties. One major recycler noted that they would be interested in this sort of activity.

6.2.10 Prevent Cherry-Picking of Recyclables

Builders tended to want to take the materials to one site to limit disposal cost. Where recyclers specialize in specific items this means that they have to transport separated materials to different locations. With small amounts this is not practical or economic.

6.2.11 Staffing and Professionalisation of Tips and Landfills

All stakeholders had stories to tell about incidences at landfills in relation to poor practice or lack of safety or clients rorting the rules of disposal. They felt that training of landfill managers was not only important for governments to ensure good practice and best management of the facilities but also for the users to ensure work place health and safety is maintained.

6.2.12 Information

Readily accessible information through telephone applications (apps) were suggested in a number of workshops and discussed with enthusiasm. Three
separate issues were raised as needing to be addressed through information which could be provided through this media:

- The location of waste disposal and recycling facilities
- A market or mechanism for alerting or connecting those who need soil with those who have excess.
- Information about fees, opening times, restrictions on access etc of waste facilities in the whole region.

6.3 Other Strategies not raised in the workshops or interviews which could be considered

There are a number of other strategies which the literature has raised which might be considered for application in the region.

6.3.1 Enforcement of Waste Transfer Notes/Certificates

A Waste Transfer Note (WTN) is a document which must be completed and accompany any transfer of waste between different holders. A WTN must be created for each load of waste that leaves a site. The WTN must contain enough information about the waste to enable anyone coming into contact with it to handle it safely and either dispose of it or allow it to be recovered within the law. Failure to give enough information may result in prosecution. Governments might consider making the client/home owner the responsible person in cases of demolition for this WTN and builders where they are the owners during the construction phase. Such action might raise awareness of the importance of the issue. However, this mechanism would have a cost factor in terms of compliance auditing.

6.3.2 Increase Enforcement Against Illegal Dumping

If the cost of disposal increases there will be a possible increase in ‘fly tipping’ or illegal dumping. This measure could involve period, high-profile “blitzes” on illegal dumping. Each “blitz” would target known problem areas for illegal dumping, particularly of building product waste. Each “blitz” would be accompanied by a media campaign advertising penalties and numbers of people fined. During the period of this study, a number of local government areas have instigated blitzes on illegal dumping.

6.3.3 Introduction of an Aggregate Tax on Quarried (Virgin) Aggregates

This is a measure introduced in the UK in 2002. The Aggregates Levy was introduced in the UK with the aim of reducing the demand for virgin aggregates, encouraging the use of recycled materials and addressing the environmental costs associated with quarrying e.g. noise, dust, and visual intrusion. The tax applies to
sand, gravel and crushed rock extracted in the UK or its territorial waters, or imported into the UK. The aggregate will become liable to the levy when it is commercially exploited, and is charged at £1.60 per tonne. The levy does not apply to coal, clay, metals, gemstones and industrial minerals. Such a scheme could be introduced in the region but would be more appropriate/effective if it was State wide. This measure would likely be resisted by local industry while there is little or no pressure on the environment and population areas of these types of activities.

6.3.4 Landfill levy escalator

The cost to dispose of mixed wastes to inert landfills is currently very cheap and does not reflect the true cost of the environmental legacy relating to air and water pollution and the future cleanup costs of these facilities. One landfill operator costed a cubic metre of landfill at $300; however a recent SERG report puts the cost between $120-$150 tonne. The current fees do not reflect these costs. The low cost of landfill also encourages the disposal of wastes rather than the recycling. The introduction of a landfill levy escalator would reflect the true cost of waste disposal and also provide a clear signal to the industry and stakeholders that the recycling of these wastes will become more cost effective than their disposal. A landfill levy escalator is a mechanism for increasing the cost of landfill over time.

An increase of say $0.50 - $2.00 per year for the next ten years may provide the industry and stakeholders with a clear signal that disposal is no longer an accepted practice, while providing time for the industry to plan and react as the levy increases. Therefore after ten years the landfill levy for inert wastes would be between $5.00 - $20.00 more than current levels. Within the NSW local government areas, this would have to be considered in the light of the separate NSW Waste Levy imposed on certain facilities.

The increased revenue could be used to fund other waste reduction and recycling programs, or for capital infrastructure such as to provide weighbridges at all landfill sites.

6.3.5 Development of C&D recycling infrastructure

There is currently insufficient infrastructure in the region to deal with all the C&D material which could be recycled. The above measures could achieve a significant diversion of building waste from landfill to recycling facilities and there is a genuine concern that there will be insufficient recycling infrastructure in place to process the increased volumes. Governments should consider working with quarry operators to develop stockpiling and processing facilities, and developing some pilot programs to test the practicality of some measures.
6.3.6 Improved Manufacturing and Design Processes

This includes issues such as:

- Construction designs minimise the production of waste due to off-cuts, i.e. specifying standard sizes
- Reviewing manufacturing processes to minimise waste production and if possible recycle any reject product.

This could be addressed in two ways: firstly through the education of architects and builders and secondly through information programs for both sectors especially if they were provided by their respective industry groups.
CHAPTER 7 Key Findings and Recommendations

7.1 Key Findings

7.1.1 Lack of Data and Tracking of Waste Production and Management

There is a lack of local data on C&D waste including the waste quantity produced, and the final disposal or recycling operation used. This information is needed to fully advance the case for the importance of action in this area.

The tracking of waste production, transportation and end use are also important to monitor the industry’s performance against waste reduction and recycling targets. However, in the ACT and region the data and tracking system are currently very limited – either because of lack of capacity to measure or different measurement systems. This is a national problem and not specific to the Capital Region.

7.1.2 Levels of Recycling of C&D Material in the Capital Region Are Well Below Best Practice

Despite the lack of accurate data, the available information indicates that the level of recycling of C&D material in the Capital Region is about 50%. This is well below the NSW average of 75% and world’s best practice of near to 100% being achieved in the Netherlands and 92% in Germany.

7.1.3 There are Considerable Barriers but Also Substantial Potential to Improve Results Despite Lack of Data

This research has revealed that despite the multiple barriers to increased levels of reuse, recycling and avoidance of C&D waste in the Capital Region, stakeholders are positive that much can be done to improve levels. The industry is positive and supportive, and government authorities have existing frameworks for cooperation which should enable them to address a number of the strategies effectively and quite quickly.

7.2 Recommendations

This study makes the following recommendations:

Recommendation 1: Consider requiring pre-sorting of C&D materials. Transition-in requirements to sort so that industry can get ready.

Recommendation 2: Review the effectiveness of Development Application (DA) waste related plans given they appear not to be followed through by government officers with an option being to set this process aside for residential development except for plans in relation to location of waste facilities in multi-unit facilities.
Recommendation 3: Enforce/require Waste Transfer Certificates for all loads showing origin address and content for the recycler or waste management. Make the home owner, land owner take responsibility for the waste by having to sign the docket.

Recommendation 4: Pricing – use pricing to provide penalties for contamination of loads and reward sorting. Where there is mixed loads due to small quantities, make these a higher price.

Recommendation 5: Education and training- provide courses for building cadets and apprentices; provide education and training of tip operators.

Recommendation 6: Provide education and media for the public and the industry on sorting of building and renovation materials, and bagging of building materials.

Recommendation 7: In consultation with the EPA’s, establish sites for storage of VENM eg quarries. Quarries should be considered as potential sites for business development in materials recycling. These should be manned and gated and allow tipping of clean VENM with certification – penalise dumping and other materials.

Recommendation 8: On new residential developments of large size plan to have a temporary centralised waste area for builders to leave sorted waste for pick up by recyclers during the development.

Recommendation 9: Establish a website or telephone application to develop a market or exchange in soil.

Recommendation 10: Establish a regional website or telephone application to provide information at the location, opening hours and restrictions of all landfill sites.

Recommendation 11: Pilot social enterprises being involved in sorting construction and demolition wastes on projects through government and private sector contracts.

Recommendation 12: Require a demonstrated waste management culture and policy under Prequalification systems for government contracts.

Recommendation 13: Require Tenders for government contracts to have criteria which favour recycling of materials.

Recommendation 14: Determine and fix a standard and protocol for the collection of C&D waste data.
REFERENCES


Crossin, E., Hedayati, M., Clune, S., 2014. Waste avoidance and reuse strategies for residential building in Australia, RMIT University, Centre for Design.


SKM, Modelling and data analysis to inform new waste strategy. Prepared for NSW Environment Protection Authority, Sydney.


APPENDIX 1: RESEARCH PROPOSAL

Construction and Engineering Materials Reduce, Reuse and Recycle: Risk, Opportunity and Strategy

A RESEARCH PROJECT JOINTLY PROPOSED BY UNIVERSITY OF CANBERRA (UC), CANBERRA BUSINESS COUNCIL, AND MASTER BUILDERS ASSOCIATION (MBA) OF THE ACT

Prepared by Professor Patrick XW Zou, Chair of Building and Construction Management & Fellow of ANZSOG Institute for Governance, University of Canberra.

Research Objectives

The aims of this research project are to:

1. Identify types and scale of reusable and recyclable materials generated in residential construction, renovation and demolition;
2. Identify possible reuse and recycle methods;
3. Identify barriers, risks and opportunities (such as cost-benefit, time pressure, product quality, demand, acceptability and incentives) in the recycling/reuse process;
4. Investigate strategies that may facilitate material reduce, reuse and recycle from stakeholder perspectives. Where possible, foster the establishment of new or expanding enterprises utilising the results of this research project and build the results of this research project into ACT and NSW regional relevant strategy documents and ongoing strategic implementation processes.

Current Situation in the ACT and NSW

The following key points reflect the current situation in the ACT and NSW regional construction industries in regard to construction material waste minimisation (reduce, reuse and recycle):

1. An apparent disconnect between waste minimisation reporting and reality. For example, ACT No-Waste is based on paperwork submitted by builders prior to demolition or construction (the ‘Waste Management Plan’). There is no audit of what actually occurs on site; therefore recycling data collected may be misleading. NSW Regional councils likewise vary considerably in their capacity to either collect data or collect accurate data sets in this sector;
2. Detailed Waste Management Plans are not required for many projects both in the ACT and the SEROC region;
3. The ACT target date for No-Waste has been delayed and now removed;
4. The NSW Government is extremely keen to improve C&I diversion rates from landfill;
5. Among a number of issues, the time pressures facing builders to demolish or construct may limit the desire to recycle, particularly where sites do not have sufficient space to sort and store materials;
6. It appears that construction materials are often over-ordered, and building designs may not consider efficient use of building materials to minimise waste;
7. Lack of knowledge amongst the general public about the opportunities for reuse and recycling;
8. In NSW many major construction sites are facing the issue of waste minimisation, reuse or recycling;
9. The challenge in regional NSW is to work with medium and small or micro companies.

Given the above mentioned current situation, there is a need for strategic actions to be developed and implemented which will:

1. Minimise construction and demolition wastes;
2. Encourage designers and constructors to reuse and/or recycle the waste by establishing cost-benefit of reuse or recycle;
3. Investigate risks and opportunities for construction recycling and reuse in the ACT and regional NSW; and
4. Encourage the industry and the general public to seek sustainable construction principles and new business models on their building projects.

Research Questions

Given the above research aims and current situation, this research will attempt to answer the following research questions:

1. What are the types of the recyclable and reusable materials in the ACT and SEROC region C&I waste streams?
2. What are the methods/ways for reusing and recycling the materials?
3. Who would be interested in using the recycled materials?
4. What are the barriers (e.g., cost, risk, and opportunities) for the interested stakeholders to reuse the product?
5. What are the strategies (such as new business models) for encouraging reuse and recycle?

Research Methods and Processes

The following research methods and steps will be adapted where suitable:

1. Desktop research;
2. Interviews;
3. Focus group workshops.

Step 1: identify recyclable types and scale of materials (2 months)

Based on the data already available from SEROC, SERRG and participating companies, a review of the literature and analysis of the available data will be undertaken regarding C&I waste streams and identify any missing data. Data and support will be provided from SERRG and the industry participating companies. The current anticipation is focused on four types, namely steel, concrete, glass and plasterboard.

Where appropriate and needed, participating builders will be asked to complete a simple data sheet of waste materials / recycled materials. Where demolition is involved, research assistants may undertake a stocktake of materials prior to demolition.

Where appropriate or needed, a focused group workshop may be arranged to verify the reusable or recycle materials.
Step 2: identify possible reuse methods and potential market demands (2 month)

Desktop research will be conducted to identify the possible reuse methods. The methods will be verified by industry practitioners via focused workshops or interviews. A profile of possible interested stakeholders will be developed during the communication with the workshop participants or interviews. Further, a potential market demand (i.e. opportunity) will be analysed via literature review, focused workshop or interview.

Outcomes of Steps 1 and 2: A Desktop study outlining the main types of reusable and recycle materials generated from construction sites; their reusable methods and potential market demand and interested stakeholders (buyers).

Step 3: Identify barriers (including cost) in the reuse and recycle process (3 months)

Barriers and risks (such as cost, time, quality, acceptability, and incentive), will be first identified from review of literature, then a focused group workshop may be organised to validate the findings from literature review, new barriers or risks may be added. Desktop study will be carried out to identify and classify components of costs and followed by interviews or case study to map the total costs. Wherever possible and suitable life-cycle cost models may be used. The ACT and NSW Regional local contexts will be taken into consideration when identifying the barriers.

It is noted that the expertise contained within the SSIG will allow us to undertake most of this work without extensive external consultation.

Step 4: Investigate strategy for reusing and recycling (3 months)

Possible strategies and recommendations, in the forms of flowcharts or similar, for overcoming the barriers, future actions (or new business models, and training plans) for relevant stakeholders will be developed through literature review and focused group workshop. Suggestions will be made for putting the research findings into practice with funding bodies.

Step 5 Summarise and disseminate research results (2 months)

This step includes summarise, write up and disseminate the research outcomes internally and externally. A focused group workshop may be arranged to assess the draft research report that includes the outcomes of all above four steps.

Expected Outcomes and Potential Implications to Practice, Education and Training

There will be several outcomes:

Stage 1: February, 2014 (i.e the Outcomes of Steps 1 and 2)

1. A Desktop study outlining the main types of reusable and recycle materials generated from typical residential construction sites; their reusable methods and potential market demand and interested stakeholders (buyers):
Stage 2: November, 2014

2. A report that includes the results of step 1, identifies barriers to business diverting such materials away from landfill and for recycling, including costs, sets down a practical business strategy for contractors to implement to overcome the barriers for minimising the waste and/or effectively manage and discarded items, lists recommendations for future action by the government and industry stakeholders;

3. A set of ‘fact sheets’, an executive summary and a clear flow chart of the necessary actions to be taken to achieve the outcomes desired and made available through UC, CBC and MBA websites.

4. A PowerPoint presentation for use by project participating companies, UC, CBC and MBA.

Additionally, a brief progress report is required for each Project Control Group meeting.

There is a potential that the findings and outcomes of this research be applied in relevant sites, in NSW and in the ACT construction industry through Canberra Business Council and MBA and across the SEROC region.

The results of this research might be included in the SEROC regional waste stream strategy and its associated planning efforts.

A direct application of the research outcomes will be the use of the research outcomes in UC’s teaching and students learning. Research papers may be developed and submitted to relevant international peer reviewed journals or conferences.

Timeline

It will require about one year (12 months) to implement this research project, as discussed above.

Project Management

Project control group

Vicki Still (CBC SSIG, also Managing Director, Easy Care Landscapes) – Chair,
Marcus Graham (CBC SSIG, also Practice Principal, Colin Stewart Architect),
Christina Faulks (CBC, CEO),
Geoff Pryor (South East Resource Recovery Group),
Jerry Howard (Deputy Chief Officer, MBA),
Matt Williams (Sustainability Manager NSW & ACT, Lend Lease),
Professor Patrick XW Zou (Chair of Building and Construction Management, UC)

This group will hold a bimonthly meeting from commencement to steer the research direction and progress as required.

Project implementation team

2. Professor Andy Dainty (Loughborough University UK) http://www.lboro.ac.uk/departments/cv/staff/profile/78.html
3. Dr Rebecca Yang (Deakin University)  http://www.deakin.edu.au/contact/staff-profile?pid=8552
4. Professor Brian Uy (University of New South Wales) http://www.civeng.unsw.edu.au/staff/brian_uy
5. Adjunct Professor Robyn Hardy (UC)
6. Dr Gillian McFeat (UC)
APPENDIX 2 – SUMMARY OF OUTCOMES OF WORKSHOPS

To fulfill an activity identified for the research project, five workshops were conducted in the South East NSW Region and the ACT. The workshops invited construction practitioners, recycling enterprises and council members to validate the findings from the previous desktop research activities and to identify barriers, issues and strategies of waste minimisation and recycling. The workshops were held in Queanbeyan, Moruya (Eurobodalla Shire), Yass, Young and Canberra on the 5th, 7th, 12th, 14th, 19th August 2014 respectively.

In general, the workshops confirmed that it is uncommon to see significant recycling and reuse in residential building. The literature provided a range of issues, barriers and/or disincentives to recycling or reuse. These included: that an inherent cause of waste could be attributed to ‘head of pipe’ or beginning of a build where non-standard design, design changes, design errors in measurement and choices made by clients who may not well informed create waste. A ‘culture of over ordering’, human error and breakage, failure to protect materials occurs on site, transportation damage and weather events are also contributory factors. In addition, rules, regulations and costs inhibit the incentive to recycle and minimise waste. The workshops explored these barriers and considered potential responses in the region.

The Workshop attendees were provided with an introduction to the research and some background data including the research done by RMIT in relation to waste calculated during construction of homes in Victoria. One attendee commented that the 9.1 tonnes of waste calculated in that study ‘might be a bit high’.

Issues/barriers

Accurate data

The availability of data was raised as an issue. Although advised that annual reports of data on tonnage of C&D waste are available (Queanbeyan workshop), the lack of accurate data on the volume and composition of C&D waste is not always publicly available across all jurisdictions. Data consists of estimates especially where there are no weighbridges in facilities that are often unmanned, or loosely managed or where loads are cursorily inspected or not at all. This lack of data is inhibiting policy development and planning for this waste type according to the waste managers.

Priorities

From the workshops, there is a sense that the waste facility managers (Councils and ACT NOWaste) do not really consider C&D waste as a top priority. They are more concerned with residential and commercial waste which is in greater quantities. Builders however do see it as a problem for them. It is certainly seen as a cost of operating, and some (not many) are concerned about the environmental issues. This is where data becomes important to convince authorities of the quantum of the problem and potential.

Waste versus resources

C&D material is not really considered as a potential resource, except perhaps for metal. Of all of the materials left over from residential building and construction, the workshops identified metal as the most often gathered material for recycling because there is a strong market for it. Generally
C&D material is viewed as waste and its potential is largely undervalued by the builders and the market.

Regulations

The ACT outsources or contracts out waste management. Councils on the other hand run their own landfills and have different rules and fee structures. Regarding variable regulations across operators and borders, the issue of consistency across the region and Councils was raised. This not only related to the fees and charges of the different landfill sites and their rules and acceptance policies but also to the regulations imposed by the different authorities which have jurisdiction over waste management – the Local Governments and the Environment Protection Authorities. Comments from workshops supported the need for greater consistency. “There is total disconnect (mishmash) between regulations and regulators” (Moruya workshop). One participant called for singular control of waste and the environment similar to that which is invoked during natural disasters such as major fire events to remedy the disconnect “There is a need for unilateral rules” (Young workshop).

It was also suggested that the NSW Protection of the Environment and Operations (POEO) Act is working contrary to recycling (Queanbeyan workshop). “Regulations, fee structures, capabilities, EPA (does not allow storage) this works against recycling” (Yass workshop) [see below].

A participant noted that Council does not allow a skip in front of a site or on the median strip and that is a disincentive to recycle (Moruya workshop). Difficulties with storage on residential sites and space for waste were frequently noted. Although in one council area it was noted “Council provides a service of multiple skips for the lifecycle of the build. Materials for disposal change as the job progresses” (Moruya workshop).

When Council representatives were asked about cooperation and consistency across the jurisdictions, they cited issues such as differing budget structures and capacities driving different fee settings and regulations and that not all Council areas interrelated geographically making it inappropriate.

Enforced regulation that makes builders sort waste from recyclables was supported by some and not others. Everyone preferred a system of incentives.

Price differential for recycling and dumping

Higher tip fees and separate bins are an issue that discourage recycling (Yass workshop). The price-line issue sees one participant preferring “to drive distances to tip waste material” (Moruya workshop). Regarding recycling and reuse, one participant questioned the actual worth versus value of the recycled product. For materials to be reused the costs are increased (Yass workshop). This comment was repeated at another workshop in the context that there is no guarantee of product standard (Moruya). Micro builders face the same issues/disincentives. Population size, distance, transport costs, pricing volume are issues and barriers that counter recycling. That said, the ACT is one of the highest jurisdictions for recycling [this is probably measured more in terms of domestic recycling] (Canberra workshop).

With regard to deconstruction, the cost differential is greater; it takes more time and comes out on a par and 90% of material goes to waste and 10% to recycling (Moruya workshop).
The fee structures for mixed waste were seen as needing to be part of any waste strategy. The price differential needs to be right. For example, put tip fees at $200 and recycling fees are $100 (Canberra workshop) or as proposed at the Queanbeyan workshop pay builders a small return say $5 tonne for recyclables and recoup it on mixed waste at $205 tonne. There is also a need for price differential in charge rates between separated and unseparated materials (Yass workshop). “Irrespective of what is in a skip, the cost is the same” (Young workshop). For example irrespective of waste loads, assessment depends on weight and where mixed waste is inexpensive is ‘pays’ builders to dispose of it that way rather than recycle or sort for recycling. In a number of instances there is no advantage to recycle because industry is being charged by the landfill operator for taking recyclable materials similarly to waste material (Young workshop).

Regarding cost as a barrier, regulation around deconstruction and demolition was also noted as a cause of escalated cost. Although, the demolition industry participants seemed more inclined to recycle due to the market for some materials and avoidance of disposal costs.

 awn Protection Authority (EPA)

The NSW Environment Protection Authority’s role in waste management and recycling was raised on numerous occasions. The EPA puts a levy on some councils located close to the Sydney CBD area with regard to waste but for others not all.

EPA regulations appear to “get in the way of the potential for recycling regarding stockpiling” (Young workshop). There is a consensus of opinion that Councils are pressured and react to NSW EPA (Moruya workshop). Further comments that support disincentive to recycle state “For SE Councils, the legislation prevents stockpiling. The problem is that the EPA is considering lowering thresholds further and this makes recycling uneconomic,” and “The fundamental dichotomy in EPA policy forces non-stockpiling for environmental reasons and makes recycling uneconomic” (Moruya workshop). Quantities determine that large amounts are seen as a different business requiring a Development Application. It was strongly suggested that the EPA regulations in relation to stockpiling and recycling needs to change and that Councils need to consult each other and with the EPA concerning this issue (Moruya workshop). A view expressed is that the EPA’s viewpoint is narrowly environmental and not holistic (Young workshop).

Another issue raised by Councils was the lack of recognition by the NSW EPA of material diverted from ‘waste’ but recycled on site. For example, where soil, wood waste and green material are recycled and used as landfill cover, the EPA does not recognise this for the purpose of ‘diverted material’ even though the use of this material means that the landfill manager does not have to buy in soil to use as cover. “Unless material is moved out it does not meet the diversion rate” (Yass workshop).

Lack of facilities for recycling

The lack of facilities for the full suite of recycling building waste leads to sorting issues (Moruya workshop). The lack of facilities and, that there are no crushers or machines that can deal with gyprock, polystyrene or materials are also barriers that discourage recycling. The issue is with the ability to deal with waste coupled with uneconomic amounts that then go to landfill (Canberra workshop).

The lack of suitable sites especially for soil disposal, plasterboard and packaging (Masonite, plastic, cardboard) was also identified as a disincentive to recycle (Queanbeyan workshop).
Other sub-issues around facilities include that not all recyclers will accept all materials for recycling causing the builder to have to take material to several places, driving cost and inconvenience.

Lack of information about recycling facilities was also frequently cited as a problem.

**Dumping**

Illegal dumping has become an issue for the Shires surrounding Canberra (Young workshop) due to the lack of or inconvenience of landfill and recycling sites. The major problem is soil but other waste dumping is occurring. Dumping of virgin material soils in particular was cited (Canberra workshop). An associated issue for the region is that disposal shopping occurs due to variances in fees and stringency of landfill management and because it is easier and cheaper to dispose of C&D material to landfill. Many builders cited landfill locations which accepted materials at no cost or little cost.

Participants across workshops concurred that there were few controls. EPA fines appear selective and depend on the EPA personnel and the work. Several examples of heavy regulation of minor infringements and were provided (Canberra workshop).

**Disposal Management and Policy**

Landfill sites are expensive to run (Queanbeyan workshop) and governments are expecting landfill managers to run these facilities as businesses. Notwithstanding this, thinking in the industry and with consumers tends to be ‘short-term thinking’ influenced by ongoing budget issues. A cubic metre of landfill was estimated to be worth/cost $300. The following comments flagged reflect this. “The bigger issue is that the community is paying more for their waste management systems” (Young workshop). “Landfill pricing for waste [not recycling] is the issue” (Yass workshop).

From attendees across the workshops, the consensus is that landfill sites are not all well managed and that fees for waste are not high enough (possibly influenced by political factors) and that recycling is not encouraged by the fee structures for recyclables although one participant noted “It is easier to dispose to Sydney than in the bush” (Young workshop). However, one workshop cited a landfill that was ‘very tidy and very well managed. The fellow who runs it is very strict about what goes where”.

At the Moruya workshop a participant said that the constraint of landfill space is an issue. A suggestion was made that small landfill sites could be used as transfer stations for C&D materials rather than tips (Queanbeyan workshop). At the Canberra workshop it was expressed that the ACT has options. The volume that goes to landfill however needs large-scale facilities and therefore investment to capture commercial waste (Canberra workshop).

The issue of unstaffed/poorly staffed landfill sites was raised. Seen as ‘dangerous,’ there is a push to close them. The issue of suitable, able-bodied persons and trained persons employed at tips was raised in relation to identification of suitable C&D material (Young workshop). Work health safety issues were raised regarding tip operations (Queanbeyan workshop) and at the Young workshop where a participant said “People who run the tip may not know what materials they are receiving or handling” (Young workshop). A participant at the Yass workshop said that landfills are manned and inspected twice a day and some loads are rejected (Yass workshop). At the Young workshop, a comment was made that tips shut when it rains due to minor flooding and inundation of the road pathways resulting in builders having to seek disposal elsewhere.
The question was asked about what sort of education would be needed for staff operating waste management facilities to ensure professionalization of the industry and necessary understanding handling of materials. Participants were unsure.

**Material specifications for building**

Specifications and guidelines add constraint on the builder to recycle or reuse (Canberra workshop). For example, building standards and regulation prevent most use of recycled materials in new builds except in say sub-base, trenches for pip works. There is a gap in certification/service testing for reuse (Moruya workshop).

RTA Specifications for road base (with respect to recycled concrete) was also raised and the need for soil testing and supplier certificates in cases of soil spoil being provided for fill requirements across the EPA to Council (Yass workshop) although a number of the builders understood the underlying principle behind such regulation. The NSW and ACT EPAs do not allow moving materials between sites without authority (Canberra and Moruya workshops).

**Markets for recyclables**

Participants varied in their opinions about the markets for recyclables however most noted there is no market for MDF, pine wood, painted timber but there is for crushed concrete, brick, asphalt which is at times in short supply (Queanbeyan, Moruya workshops). With respect to gyprock participants were unevenly informed. Some believed there was no market (this appears to be a lack of information as Regyp of Cowra accept materials in Canberra for recycling and there is considerable demand by farmers for this material when turned into gypsum). The issue may be more about collection points.


When quizzed about their use of recycled material, even Council representatives were hesitant to say that they used their own recycled materials in landscaping.

**Contaminated material**

“EPA rules vary from region to region. There should be a national rule for every town, council and tip operation.” Regarding contaminated materials i.e. asbestos, it was suggested, “There needs to be clarity around rules.” “There should be protocols to manage asbestos that are clear and realistic. There are issues that need to be understood.” A question was asked about what the EPA, WorkCover and Council “are achieving in regard to asbestos” (Young workshop).

“It is at enormous cost that industry disposes of contaminated material to the nearest licenced landfill.” A question was raised whether a forum exists for industry to talk collectively to Council (Young workshop).

Participants accepted the need for identification of the sources of contaminated material and that loads need to be “trackable.”

**Waste Management Plans (WMPs)**

Almost all participants noted that WMPs were required by government planning authorities but not followed through. At one workshop the question was asked if WMPs are audited. The response was that random audits are conducted on Housing Commission sites (Young workshop). At another
workshop, the collective response was unclear (Moruya workshop). It appears that the plans are not fulfilling their main purpose.

Gaps in Information

Many participants raised the issue of information about what could be recycled, where and at what cost was needed for the industry.

All participants agreed to the need for some sort of information sharing solution especially with regard to soil excavated from building sites. Many others raised the need for better/real time information about where building material could be taken for recycling. The inconvenience of having to ‘shop around’ for places to take materials was often cited as a significant issue.

Training

Almost all workshops agreed that training and education over time would improve attitudes to recycling by builders and the level of recycling.

Preferred over media campaigns [for the industry] were training for cadet builders and education of the industry (Queanbeyan workshop). The education of “older builders” was suggested best conducted in tandem with the introduction of a training regimen for cadet builders. These programs were preferred over media blasts (Moruya workshop). Who should take responsibility for this type of training was divided. One response was to work with architects and interior design students, “It comes down to decision makers” (Yass workshop). Another response was “It comes back to councils to do this” (Young workshop).

Education of the public

Most workshops noted that the public/clients were unaware and disinterested in C&D waste – their major concern was about the cost of the build. However, two builders did point out that they tended to get work because people noticed that they had ‘tidy sites’. Participants were ambivalent about the need to educate the public about the issues surrounding C&D waste and why recycling is important. Council representatives noted that work is done in primary school level with regard to recycling in general but that this work loses its impact at high school level and afterward.

Incentives and Opportunities

All participants noted that there should be incentives and opportunities to recycle. This was voiced in all the workshops. It was suggested, “Younger builders will recycle given the opportunity” (Moruya workshop). However, incentives alone are not seen as sufficient inducement to recycle. Relationships, regulation, information, convenience and fees should be considered together (Moruya workshop).

Potential solutions raised by the workshops:

- Education and training of builders and designers (agreement across all workshops)
- Education and training of waste management facility operators
- Education and training for government procurement people
- Targeted media for the public to inform them about possibilities
- More scientific research into what to do with certain materials in the Australian context
- Examination of specifications for building which allows for recycled materials use
Procurement incentives eg 10% leeway on recycled materials in government contracts (Canberra workshop)

Enforcing WMPs or scrapping them

Regulation to force builders to separate and recycle certain materials

Fee differential incentives to separate/sort recyclable materials from non-recyclables (all workshops)

Support for businesses/companies for recycling and reusing e.g. an industry support scheme (Yass workshop)

In the ACT, the Land Development Authority (LDA) dedicating temporary parcels of land for waste material storage for building sites. Fenced-off for security reasons the site should also be managed (Canberra workshop). This could also be replicated in other Capital region areas.

Stop allowing cherry picking of recyclables (Queanbeyan workshop) or in other words, make recycling easier by having one stop shops.

Ensure all landfill sites are professionally manned and operated (Queanbeyan workshop)

Encouragement of a business of Waste brokers as in Europe (Queanbeyan workshop)

An information App and mapping exercise to identify waste and recycling facilities. This would have to be maintained as a service. This could be generated by say the MBA as a Members’ Services alert made available on their website (Canberra workshop)

An information APP which brings together buyers/builders who need soil and those who have soil and need to dispose of it. This need not involve any fees but be solely an information service.

Onsite sorting services provided by third parties to create a business opportunity and or social enterprise. Builders sponsor social enterprises to clean up sites.

An app solution that provides the most cost efficient route to a facility/sustainability hub (Queanbeyan workshop)

Regulation at state and Commonwealth level should be introduced for manufacturers to take back product and packaging and for rating its recyclability. Encouraging the Packaging Covenant.

A footprint of de-making should be considered.

Establishing a “star rating” for new home construction similar to commercial building that rewards resource saving and recycling and better practice from operational waste. The issues raised were costs and a certifier.
### Appendix 3 – Questions for Interviews

#### Questions for Managers of Landfill sites

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1. Do your landfills accept all C&D materials or are there restrictions?
2. What are you currently charging for various C&D materials to be deposited at your landfill sites?
3. Are all of your landfill sites manned by staff fulltime?
4. Do you encounter any management problems at the landfill sites?
5. Does the area suffer from illegal dumping? Why do you think this is?
6. Do all of your landfill sites have the capacity to weigh material sent to landfill?
7. Do you manufacture any C&D product into recycled material (eg crush concrete)?
8. What is your market/end use for this product?
9. Page 35 of the Waste Stream Mapping Opportunities for the Greater Capital Region report (attached) has a table of estimated quantities of C&D waste. Do you concur with the figures or could you provide a more accurate estimate. Can you indicate how much could be processed or recoverable?
10. Do you have any suggestions or particular solutions to C&D waste which you would like to share with us?
APPENDIX 4 – OUTCOMES OF TELEPHONE AND FACE TO FACE INTERVIEWS

To gain further information on C&D waste management, selected shires, a waste facility managers, a recycler/products manufacturer across the capital region were sent questions. A follow up phone interview was made to ascertain if there were further issues and useful information that could be included in the report.

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<thead>
<tr>
<th>Questionnaire/Interview sent to:</th>
<th>Response</th>
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<tbody>
<tr>
<td>Products Manufacturer</td>
<td>1/1</td>
</tr>
<tr>
<td>Recycler</td>
<td>1/1</td>
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<tr>
<td>Waste Manager</td>
<td>1 (responsible for 8 shires)</td>
</tr>
<tr>
<td>Shires &amp; ACT No Waste</td>
<td>6 sent/4 responses (The questionnaire was sent to 2 different positions within 1 Council)</td>
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A. Response from Products Manufacturer/Recycler

Question 1: What do you recycle?

Their recycling amounts to a resource recovery facility that specialises in recovering C&D materials such as concrete, brick and asphalt.

Question 2: What are you currently charging for various C&D materials to be deposited at your landfill sites?

The products manufacturer quoted current charges ranging from $5 - $8 per tonne for concrete, $7 - $10 per tonne for brick and $9 - $12 per tonne for asphalt.

Question 3: Do you have the capacity to weigh material sent to you?

The product manufacturer has a weighbridge.

Question 4: Do you manufacture any product other than C&D into recycled material?

The product manufacturer recycles C&D product.

Question 5: What is your market/end use for this product?

The product manufacturer stated civil, major Infrastructure, reseller, utilities as their market that is processed and supplied back into the ACT market.

Question 6: Can you indicate how much could be processed or recoverable?

The product manufacturer supplied recycling statistics for Year 2013/14. They are as follows:

Total Tonnes Recovered: (From the ACT)

Construction and Demolition Waste – Concrete 20000
Construction and Demolition Waste – Bricks 5000
Construction and Demolition Waste – Asphalt 800
Metals (ferrous) 250
Current stockpile in tonnes 2013/14

Construction and Demolition Waste – Concrete 3000
Construction and Demolition Waste – Bricks 1000
Construction and Demolition Waste – Asphalt 700
Metals (ferrous) Nil. All Ferrous sent to local scrap metal recovery facility

Question 7: Do you have any suggestions or particular solutions to C&D waste which you would like to share with us?

The products manufacture said, “Due to the abundance of natural resources (natural quarries) within and outside the territory, it is difficult to obtain a cultural change to accept the use of recycled material as a construction material. A training program through industry forums driven by the ACT would be great to encourage the use of recycled material only if the supplier has tight control in their QA process.”

B. Response from Recycler

Question 1: Does your facility accept all C&D materials or are there restrictions?

The recycler stated that the only restrictions are for hazardous materials and mattresses.

Question 2: What are you currently charging for various C&D materials to be deposited at your landfill sites?

Although their website sets out a pricing policy based on “the waste and product type” and that “some waste and products may be charged by volume” no actual prices were made available from the recycler. Nonconforming loads incur extra handling/disposal costs.

Question 3: Is your site manned by staff fulltime?

The recycler’s site is manned.

Question 4: Do you encounter any management problems at the site?

The recycler said that “customers hide materials to avoid payment and suggested that customers need educating on what is and isn’t recyclable.”

Question 5: Does the area suffer from illegal dumping? Why do you think this is?

The recycler confirmed that they do experience illegal dumping in particular with asbestos.

The recycler’s response was, “We do. In particular asbestos. Minority don’t know and the rest to avoid the cost involved.”

Question 6: Do you have the capacity to weigh material?

The recycler operates a weighbridge and weighs everything in and out of their site.

Question 7: Do you manufacture any C&D product into recycled material (e.g. crush concrete)?

The recycler has a “Large range of recycled products at lower prices than raw materials.” E.g. aggregates, asphalt millings, scalps, crusher dust, crushed concrete, recycled hardwood.
Question 8: What is your market/end use for this product?

The recycler’s website cites “96% resource recovery of your construction and demolition materials” and “We continue to provide our customers with Green Star Building reports to certify the quantities recycled from individual projects. Many customers use our facility to have their waste recycled into products that they can then use on their projects, thereby closing the recycling loop.”

Question 9: Do you have any suggestions or particular solutions to C&D waste which you would like to share with us?

The recycler said their main issue “at the moment is the EPA working with the industry and that the industry is regulated properly, so that rogue operators don’t enter the market and create stockpiles of waste instead of recycling.”

C. Responses from Shire Waste Managers

Question 1: Do your landfills accept all C&D materials or are there restrictions?

- Accepted without restrictions.
- C&D waste is accepted including landfill upon application and if required for use at the site/s.
- “We accept most things, except hazardous and toxic, highly flammable material.”
- Waste is accepted only from their shire
- Yes (only from within our shire)

Question 2: What are you currently charging for various C&D materials to be deposited at your landfill sites?

- The commercial rate is $99/tonne.
- One shire determines its fees and charges according to the categories of
  - Waste - includes mixed waste, building material, putrescible and non-putrescible waste that requires burial
  - Full waste charge will be applied to all unsorted loads. Operational - Stumps (clean with no soil attached), large quantity of palm fronds, palm trees, logs greater than 200mm diameter, mixed concrete, bricks and masonry, treated timber, painted timber, timber with nails, fittings still attached, manufactured timber products etc. that do not require burial but are not sold off site. At the discretion of the weighbridge operator and
  - Recoverable - building material including clean bricks/masonry, clean timber, vegetation that does not require burial and items for the buy-back shop.

Loads are charged according to size or weight. Prices 2014-15 plus GST are:

- Small load (equal to Sedan boot) - waste $11.50 per load
- Small load (equal to Sedan boot) - operational not landfilled - $7.50 per load
- Small load (equal to Sedan boot) - recoverable - $5.00 per load
- Medium load (equal to Utility/Wagon/Trailer) - waste - $27.00
- Medium load (equal to Utility/Wagon/Trailer) - operational not landfilled - $19.00
- Medium load (equal to Utility/Wagon/Trailer) - recoverable - $13.00
- Large load (equal to Heaped Utility/Wagon/Trailer) - waste - $40.00
- Large load (equal to Heaped Utility/Wagon/Trailer) - operational not landfilled - $30.00
Large load (equal to Heaped Utility/Wagon/Trailer) - recoverable - $18.00

A sample of prices cited by other shires that responded is as follows:

- Soil at $10/tonne, Concrete at $76.00/tonne and Recyclable iron at $76.00/tonne
- Mixed Demolition $96.00/per tonne, Mixed Demolition outside of shire $160.00 per tonne, Concrete /bricks (>brick size) $45.00 per tonne, ENM (<brick size) no charge, VENM no charge, Asbestos/ Contaminated soil $200.00 per tonne
- Ranging from $5 minimum charge to up to $150 per tonne for general waste and then we charge for Asbestos up to $250 per tonne or Huge Tyres $330 per tonne. It does vary, depending on amounts, weight and size.

The table below is from the website of a Shire interviewed.

<table>
<thead>
<tr>
<th>Construction and Demolition (C&amp;D)</th>
<th>2015</th>
</tr>
</thead>
<tbody>
<tr>
<td>VENM (Virgin Excavated Natural Material if required for landfill operation). Particles must be less than 150mm.</td>
<td>Landfill FREE</td>
</tr>
<tr>
<td>Mixed building waste (no asbestos) minimum charge</td>
<td>$20.00</td>
</tr>
<tr>
<td>Mixed building waste (no asbestos)</td>
<td>$150.00/t</td>
</tr>
<tr>
<td>Concrete containing steel reinforcement</td>
<td>$15.00</td>
</tr>
<tr>
<td>Concrete containing Steel reinforcement</td>
<td>$90.00/t</td>
</tr>
<tr>
<td>Concrete/bricks/tiles/rubble minimum charge</td>
<td>$10.00</td>
</tr>
<tr>
<td>Concrete/bricks/tiles/rubble including VENM with particles greater than 150mm</td>
<td>$65.00/t</td>
</tr>
<tr>
<td>Timber - untreated/ unpainted minimum charge</td>
<td>$10.00</td>
</tr>
<tr>
<td>Timber - untreated/ unpainted</td>
<td>$65.00/t</td>
</tr>
<tr>
<td>Other treated timbers/particleboard etc. minimum charge</td>
<td>$15.00</td>
</tr>
<tr>
<td>Other treated timbers/particle board etc</td>
<td>$135.00/t</td>
</tr>
<tr>
<td>Asbestos - small loads minimum charge (per bag, sheet or length). The receipt of asbestos is only by prior arrangement and will only be accepted if permitted and disposal space is available</td>
<td>$35.00 ea</td>
</tr>
<tr>
<td>Asbestos - Trailer standard single axle (per load)</td>
<td>$215.00/t</td>
</tr>
</tbody>
</table>

Question 3: Are all of your landfill sites manned by staff fulltime?

Yes.

Shires which responded said that landfill sites are manned. Landfills, operating and staffed 66 hours per week. (1 Shire)
Question 4: Do you encounter any management problems at the landfill sites?

- No.
- Staffing levels are not always conducive to high level monitoring. Loads not fully declared all the time
- Do not have management problems
- Some issues with lack of staff resources to ensure customers are placing materials in correct stockpiles. Issues are with customers interpreting the fees and not wanting to pay the gate fee
- Environmental Issues and EPA requirements do have an impact on the managing of the landfill

Question 5: Does the area suffer from illegal dumping? Why do you think this is?

- Challenges imposed by EPA e.g. practical application of their regulation leads to issues. “Illegally hidden or dumping has to be cleaned up by an authorised contractor. New legislation regarding separation of asbestos requires transfer stations to apply a 20 cubic metre or incremental clearance area.” Having to segregate or dispose of contaminated material to licensed landfill impacts on the waste budget and, the onus fall to the operator. If councils find asbestos, they report to the EPA through the asbestos hotline.
- Possibly pricing leads to dumping and “it is in some peoples nature” to dump
- At the gate outside of hours and in the surrounding bush land. Not wanting to pay, or sites closed when they turn up late
- Some issues at the borders of the shire. There have been isolated instances on private land that have involved large-scale operations. The reason for this is to void tipping fees. The Health and Building department have advised that putting obligations i.e. waste must be disposed of at a lawful facility and receipts retained into developers DA’s has reduced the instance of C&D illegal dumping
- Yes, seasonal area and itinerant workers, costs due to EPA conditions

Question 6: Do all of your landfill sites have the capacity to weigh material sent to landfill?

- Yes.
- Yes.
- Yes.
- Yes.
- No.
- No.
- No.
- No.

Question 7: Do you manufacture any C&D product into recycled material (e.g. crush concrete)?

- Concrete is crushed for re-use
- Material is used on site for road construction
- We crush concrete and utilise on site. Timber is shredded and utilised as temporary rehabilitation
- We arrange crush concrete to happen on site. Resourcing materials to be sold in a second chance store at the landfill. We woodchip the green waste for firewood kindling or for extra cover on landfill

1 From workshops run by the research team, an issue for builders is the operating hours of landfill sites.
Question 8: What is your market/end use for this product?

- Used onsite only
- Internal use only
- Council use for road base
- Crushed Concrete – Road base. Items from shop to be sold to the public Green waste sawed or chipped for sale to public or gardening/landfill use

Question 9: Page 35 of the *Waste Stream Mapping Opportunities for the Greater Capital Region report* (attached)\(^2\) has a table of estimated quantities of C&D waste. Do you concur with the figures or could you provide a more accurate estimate. Can you indicate how much could be processed or recoverable?

- Council reported to the EPA 2013-2014 Yearly waste data report. C&D Total 6610.91 Tonnes this was made up of:
  - VENM 1438.12
  - ASB 123.32
- 2013/14Fy data return had the following quantities in the B&C section of the return: 21,746 tonnes (B&C – 388; VENM – remainder)
- No. Varies depending on year and any large constructions/demolitions.
- Approx. 600 tonnes of timber – only about 100 tonnes for re-use or mulch (most timber is painted, glues, fittings, CCA, treated, particle board). 2500 tonnes of concrete/bricks – estimate 2000 tonnes could be processed to meet recovered aggregate exemption and exported off site. VENM – varies depending on use and price at landfill gate (if we need it, it is free if we don’t need it full waste charge $131/tonne) – last year we charged and received 3500 tonnes. Previously when free received up to 20,000 tonnes per year
- One shire could not comment

Question 10: Do you have any suggestions or particular solutions to C&D waste which you would like to share with us?

- Subsidisation from industry/government for the processing of non-landfilled product.
  A ‘products stewardship program from industry’ would assist a shift towards better management of C&D waste materials.
  Incentives to help little councils like the e-waste program where 30m skips that go to transfer stations for electronic equipment are provided
  A landfill pit where it gets transported to regional landfill on site would be more economic.
- We can only do something with it when it is separated when it comes to us. Much more could be recovered in mixed loads if you sorted C&D waste onsite. New asbestos protocol will affect receiving C&D waste and may mean more landfilling if resources are lacking to fully screen the loads as per draft. Should be more ability for C&D companies to sort loads off site and stockpile for short periods of time
- Creating an end use for this material without having to transport the material for reprocessing
- More education to home renovators/builders before the material is deemed waste. Placing a value on the material that is greater than the tipping cost (hardwoods, exotic timbers, architectural features for re-use)
- The Trades people and National Parks in this area could do a lot more in recycling than they do currently. They put all products together and throw out into the landfill, generally unsorted building waste at one charge

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APPENDIX 5 – SURVEY OF RESIDENTIAL BUILDERS

Q1 The Canberra Business Council, the South East Regional Organisation of Councils, and the Master Builders Association of the ACT have engaged the University of Canberra to undertake some research into residential construction, renovation and demolition waste and recycling activity. This form has been developed to gather data from Residential Builders, waste and recycling industry representatives for research about the amount of building waste being collected and recycled, as well as data about the conversion of that waste into useful product. All information gathered by this survey remains confidential and only summary data (not identifying any firm, organisation or company) will be published.

Q2 How many projects do you undertake per year?

Q3 What is the volume in tonnes of building waste material that you generate per project?

Q4 What is the volume in tonnes of building waste material that you generate per year?

Q5 What is the composition of the building waste material that you generate per project by volume/tonnes?

Q6 What is the composition of the building waste material that you generate per year by volume/tonnes?

Q7 Do you recycle any waste material?

Q8 On a new home project what percentage do you recycle or send to recycling facilities?

Q9 When demolishing an existing house for a knock down rebuild project what percentage do you recycle or send to recycling facilities?

Q10 On a renovation project what percentage do you recycle or send to recycling facilities?

Q12 How much does this cost you per tonne?

Q13 Do you use any recycled products in your residential building projects?

Q14 If yes, what products?