

BARRIERS TO BUILDING AND CONSTRUCTION WASTE REDUCTION, REUSE AND RECYCLING

A CASE STUDY OF THE AUSTRALIAN CAPITAL REGION

PATRICK ZOU
SWINBURNE UNIVERSITY OF TECHNOLOGY

ROBYN HARDY
UNIVERSITY OF CANBERRA

REBECCA YANG
RMIT UNIVERSITY



Barriers To Building And Construction Waste Reduction, Reuse And Recycling: A Case Study Of The Australian Capital Region, is licensed under a Creative Commons Attribution-NonCommercial 4.0 International License.

This publication may be cited as:
Zou, P., Hardy, R. and Yang, R. (2015). barriers to building and construction waste reduction, reuse and recycling: A case study of the Australian capital region. In M. Panko and L. Kestle (Eds.). *Building Today - Saving Tomorrow: Sustainability In Construction And Deconstruction Conference Proceedings*. (pp. 27-35). Auckland, New Zealand: Unitec Institute of Technology. Retrieved from: www.unitec.ac.nz/epress/

Contact:
epress@unitec.ac.nz
www.unitec.ac.nz/epress/
Unitec Institute of Technology
Private Bag 92025, Victoria Street West
Auckland 1142

ISBN 978-1-927214-17-6



ABSTRACT

Building and construction waste materials continue to be a major problem causing significant environmental impact worldwide. Broad university-industry collaborative research was undertaken in 2014 to identify the barriers, opportunities and strategies for reducing, reusing and recycling building and construction waste materials in the Australian Capital Region (located in the south-eastern corner of Australia and includes the Australian Capital Territory). This paper presents and discusses the results in relation to the barriers and possible strategies to overcome these barriers. To identify the barriers several workshops and interviews were undertaken. The workshop participants and interviewees were first provided a list of 12 barriers derived from review of relevant literature. They were then asked to think 'outside of the box' to identify any more barriers that were not captured in the list. Seven new barriers were identified, resulting in a total of 19 barriers. This research contributes to the field by identifying new barriers and providing corresponding strategies, which were developed together with frontline practitioners and managers. The overall outcomes have led to the development of the second stage of this collaborative research project.

INTRODUCTION

The Capital region consists of 13 local government areas of the South East Region of New South Wales (NSW) and the Australian Capital Territory (ACT) (refer to Figure 1. and 2.). The region is highly interrelated in terms of industry. The construction industry is important; comprising around 14 per cent of the regions output value. Builders work across the state and local government borders of NSW and the ACT, using all waste facilities where it is convenient to do so, regardless of jurisdiction. In 2013 a group of organisations from the Australian Capital Region – broadly representing the building and construction industry and government – came together over a mutual concern that the residential component of construction and demolition waste (C&D) was largely being disposed to landfill, and economic benefit that could be generated from waste and recycling was being lost.

RESEARCH AIMS

The broader aims of the full research project were to:

1. Identify the types and scale of recyclable materials generated in residential construction, renovation and demolition;
2. Identify possible reuse and recycling methods;
3. Identify barriers, risks and opportunities in the reuse/recycling process; and
4. Investigate strategies that may facilitate material reduction, reuse and recycling.

This paper concentrates on the outcomes of the broader C&D waste research in terms of the identification of the barriers to recycling and reuse and potential strategies and responses to those barriers. It excludes types and scale of recyclable materials generated, potential reuse and recycling methods, and other factors which were examined in the full research project.

LITERATURE ON CONSTRUCTION AND DEMOLITION WASTE

The definition of construction waste adopted in this study is: *Any material from the construction process which is used onsite as landfill or is transported offsite for reuse, recycling, or landfill elsewhere.*

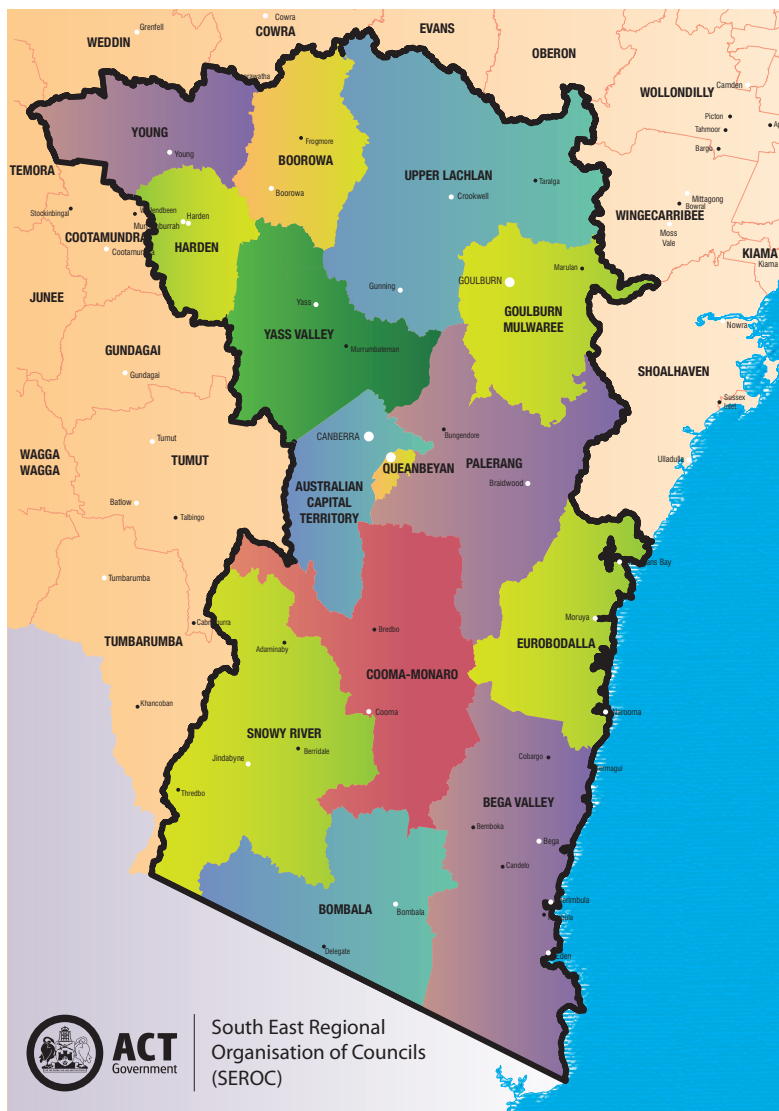


Figure 1. (left) Map of Australian Capital South East Region
 Source: Courtesy of Canberra Region Joint Organisation (formerly known as the South East Regional Organisation of Councils)

Figure 2. (above) Map of Australia highlighting South East Region
 Source: Authors own

The existing literature has examined waste, including construction and demolition (C&D) waste and its causes, from a number of different perspectives: an efficiency of manufacturing perspective (Ohno, 1978); a value or loss of value point of view (Formoso et al., 2002); a value and efficiency perspective (Skoyles, 1976); and a sources viewpoint (Gavilan & Bernold, 1994; Bossink & Brouwers, 1996). Others have considered C&D waste as a result of design and/or procurement/project management and materials handling inefficiency (Keys et al., 2000; Ekanayake & Ofori, 2000; Gamage, Osmani & Glass, 2009). Pinto (1989) and others (Soibelman et al., 1994; Pinto & Agopayan, 1994) have looked at waste by materials type, and Osmani (2006, 2007) has examined C&D waste through the prism of its lifecycle and origins.

The literature on barriers (CIB, 2014; WALGA, 2013; Boser, Bierma & El-Gafy, 2010; DSEWPC, 2012) indicates that they are numerous. They include:

1. Lack of knowledge about what can be recycled, or about recycling opportunities;
2. Contamination of recyclables due to lack of separation or lack of space for separation;
3. Lack of markets 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
12. Low value/low volume products being landfilled rather than stored for recycling because it is uneconomic to stockpile.

RESEARCH METHOD AND PROCESS

To achieve the broad research aims of the full study, the following methods were utilised:

1. Desktop study 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;
3. Interviews with waste management facility operators; and
4. Surveys of residential builders.

Five workshops were scheduled throughout the Capital Region to ensure a range of views were captured from the whole geo-political area: four were held in small rural and regional locations and one in the capital, Canberra. The workshops were held in Queanbeyan, Moruya, Yass, Young and Canberra on the 5th, 7th, 12th, 14th, 19th August 2014 respectively.

Attendees were openly invited from a range of building-related occupations via email, telephone and through the local government networks. A facilitated workshop was conducted with the same material and research questions for each group. This involved a short presentation by the researchers of the research background and the causes and barriers identified by the literature. The discussion was then opened up to the Participants. Thirty-seven people representing the full range of the building and construction industry, waste management and recycling attended the five workshops. With the majority of builders concentrated in the Canberra-Queanbeyan city areas, attendances at the workshops, while small, were considered very representative particularly of the broad spectrum of stakeholders interested in building and construction, waste and waste governance. Pre-interview electronic questionnaires were sent to relevant waste and recycling managers of six local government areas (the Shires of 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 allowing them to prepare for follow up telephone and personal interviews. Interviews were conducted with seven respondents, one of whom is responsible for managing waste in seven of the local government areas.

RESULTS AND DISCUSSION

The desktop study yielded an initial list of 12 barriers to reuse and recycling.

In this research, the workshops and interviews confirmed the barriers identified in the literature. However, the workshops identified seven additional barriers to recycling in the Australian Capital Region:

1. Most people in the industry do not consider C&D material as a potential resource (except metal) and that this mindset drives some of the behaviour to landfill all C&D material
2. Australian State Government environmental regulations are seen as working against recycling. Environment Protection Authorities do not allow stockpiling of uneconomic quantities of product due to potential contamination issues. This works to discourage recycling
3. Many workshop participants raised the issue of the lack of facilities for recycling. There are very few facilities for the recycling of C&D waste across the region and these are not conveniently located
4. Inconvenience of location of recycling facilities increases haulage costs and recycling facilities tend to 'cherry pick' the valuable C&D materials and reject others
5. The requirement for materials to meet certain specifications and standards makes it easier to select new product than go through the process of having recycled product certified for use
6. The lack of facilities to store soil particularly virgin excavated natural materials (VENM) for reuse later was considered a major issue across the region.
7. Different pricing structures between the jurisdictions constituting the Capital Region are encouraging builders to 'shop around' for the cheapest landfill sites, particularly as there appears to be little restriction on entry

The combined list of barriers is shown in Table 1. The major areas of commonality of barriers identified by the previous research (literature), the workshops and interviews were analysed. The shaded and checked boxes indicate the barriers identified by each.

The top six barriers identified by all sources were categorised as:

- **Policy and governance:** Government policy is not driving recycling;
- **Quality:** Contamination of recyclables due to lack of separation or lack of space for separation;
- **Cost:** Alternatives to recycling are cheaper – landfill gate prices are too low;
- **Information:** Lack of information re industry infrastructure;
- **Knowledge and education:** Lack of knowledge across industry and requirement for training; and
- **Perception and culture:** C&D material is not considered as a potential resource (except metal).

Barriers identified by the literature		Barriers confirmed by Local Stakeholders					
		Interviews	Workshop 1	Workshop 2	Workshop 3	Workshop 4	Workshop 5
1	Lack of knowledge about what can be recycled or recycling opportunities		✓	✓	✓	✓	✓
2	Contamination of recyclables due to lack of separation or lack of space for 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 information re industry infrastructure	✓	✓	✓	✓	✓	✓
11	Lack of knowledge across industry and requirement for training	✓	✓	✓	✓	✓	✓
12	Low value/low volume products being landfilled rather than stored for recycling because it is uneconomic to stockpile	✓	✓	✓	✓	✓	

Additional Barriers identified in the Workshops/Interviews		Barriers identified by Local Stakeholders					
		Interviews	Workshop 1	Workshop 2	Workshop 3	Workshop 4	Workshop 5
13	C&D material is not considered as a potential resource (except metal)	✓	✓	✓	✓	✓	✓
14	Environmental regulations are working against recycling	✓	✓	✓	✓	✓	✓
15	Lack of facilities for recycling		✓	✓	✓	✓	
16	Inconvenience of location of recycling facilities or need to take materials to many different places		✓	✓	✓	✓	
17	Material specification in buildings not encouraging recycling		✓	✓	✓	✓	
18	Lack of facilities to store soil particularly VENM for reuse later		✓	✓	✓	✓	✓
19	Different pricing structures between jurisdictions encouraging landfilling		✓	✓	✓	✓	

Table 1. Barriers to Building and Construction Waste Reuse and Recycling
Source: Authors own

Strategies to encourage reuse and recycling of C&D Waste

The workshops resulted in discussions about potential solutions some of which were put to the participants by the researchers and others which were nominated by the participants themselves. The proposed strategies and solutions included:

Policy and Governance, Quality and Cost related

1. Regulation by government to require manufacturers to take back product and packaging and to rate product recyclability.
2. Regulation to force builders to separate and recycle C&D materials.
3. Enforce Waste Management Plans or scrap them.
4. Use Government Procurement incentives to drive behaviour, e.g. 10% price allowance on recycled materials.
5. Establish a 'star rating' for new home construction that rewards resource saving and recycling.
6. Government allocation of temporary parcels of land for waste material storage.
7. Implement differential landfill fees to encourage recycling and discourage landfilling.
8. Examine specifications for building to ensure allowance for recycled materials use.
9. Provide support for new businesses for recycling and reusing.
10. Make recycling easier with one stop shops and prevent 'cherry picking' by recyclers.
11. Encourage onsite sorting services provided to create business opportunities.
12. Ensure that all landfill sites are professionally manned and operated.
13. Encourage waste broker businesses to source materials and potential buyers.

Information related

14. Develop an information App and map to enable ease of identification of waste and recycling facilities.
15. The App solution should provide the most cost efficient route to a recycling facility.
16. Encourage or develop an information App which brings together buyers/builders who need/have soil.

Knowledge and Education, Perception and Culture related

17. Develop a footprint of deconstruction to provide an indicator to home owner consumers of C&D projects.
18. Targeted media for the public to stimulate demand and community thinking.
19. Education and training of builders and designers, waste management facility operators and government procurement staff to raise awareness and change the mindset of waste to one of potential resource.
20. More scientific research into C&D materials in the Australian context.

CONCLUSION AND FUTURE RESEARCH

Overall, the study revealed that there are significant barriers to recycling and reuse of C&D waste in the Australian Capital Region as other research has discovered worldwide. Limitations of this study include that the further barriers which were identified, may or may not be specific to the Australian Capital Region. Among the 20 proposed strategies, many are related to government policy and information sharing, while there is also need for knowledge and perception development through better education and more research. The efficacy of these measures to reduce waste and increase the level of reuse and recycling would need to be tested. The outcomes of this research have led to the development of the second stage which will focus on these research needs.

ACKNOWLEDGEMENTS

Research undertaken by the University of Canberra and sponsored by Canberra Business Council (now Canberra Business Chamber), the South East Regional Organisation of Councils (SERO) (now Canberra Region Joint Organisation), ACT Master Builders Association (MBA), ACT NOWaste, Colin Stewart Architects, Easycare Landscapes, ACT Land Development Agency, ACT Master Builders Association, and Rock Development Group.

The following publications were made available to the researchers by SEROC:

- South East Regional Organisation of Councils (SERO). (2012). SERRG Regional waste stream management strategy, 2012-2032.
- South East Regional Organisation of Councils (SERO). (2013). SEROC Recent population trends – update to June 2012.
- South East Regional Organisation of Councils (SERO). (2010). *Regional resource recovery strategy options – including waste prevention*, Final Report June 2010, prepared by Strategic Economic Solutions.
- South East Regional Organisation of Councils (SERO). (2013). *Waste stream mapping, opportunities for the Greater Capital region*, prepared by Object Consulting, Sydney.

REFERENCES

- Boser, R., Bierma, T., & El-Gafy, M. (2010). *Overcoming barriers to P2 and recycling for construction waste*, ISTC technical report series. Illinois, USA.
- Bossink, B. & Brouwers, H. J. H. (1996). Construction waste: Quantification and source evaluation. *Journal of Construction Engineering and Management*, 122(1), 55-60.
- Crossin, E., Hedayati, M., & Clune, S. (2014). *Waste avoidance and reuse strategies for residential building in Australia*, RMIT University, Centre for Design. Retrieved from: <http://mams.rmit.edu.au/y1wjxknbixsu.pdf>
- Department of Sustainability, Environment, Water, Population and Communities (DSEWPC). (2012). *Waste and recycling in Australia 2011, final report*. Prepared by Hyder Consulting Pty Ltd for the Department, Sydney. Retrieved from: <https://www.environment.gov.au/system/files/resources/b4841c02-229b-4ff4-8b3b-ef9dd7601d34/files/waste-recycling2011.pdf>
- Ekanayake, L. L. & Ofori, G. (2000). Construction material source evaluation. *Proceedings for second Southern African conference on sustainable development in the built environment*. Pettoria, South Africa. Retrieved from: <http://www.cibworld.nl/site/databases/publications.html>
- Formoso, C., Soibelman, L., De Cesare, C. & Isatto, E. (2002). Material waste in building industry: Main causes and prevention. *Journal of Construction Engineering and Management*, 128(4), 316-325.
- Gamage, I., Osmani, M. & Glass, J. (2007). Assessing the relationship between procurement systems and waste generation in construction. In C. Egbu & M. Tong, (Eds.) *Proceedings of the third Scottish conference for postgraduate researchers of the built and natural environment* (pp.149-157). Glasgow, Scotland: Glasgow Caledonian University.
- Gavilan, R. & Bernold, L. (1994). Source evaluation of solid waste in building construction. *Journal of Construction Engineering and Management ASCE*, 120(3), 536–552.
- International Council for Research and Innovation in Building and Construction (CIB). (2014). *Barriers for deconstruction and reuse/recycling of construction materials*, (Eds.), S. Nakajima, & M. Russell, Working Commission W115, Construction Materials Stewardship.
- Keys, A. Baldwin, A. & Austin, S. (2000). *Designing to encourage waste minimisation in the construction industry*. In proceedings of CIBSE national conference. Dublin, Republic of Ireland.
- Osmani, M. (2012). Construction waste minimization in the UK: Current pressures for change and approaches. *Procedia - Social and Behavioral Sciences*, 40, 37–40.
- Osmani, M., Glass, J. & Price, A. (2006). Architect and contractor attitudes to waste minimisation. *Proceedings of the institution of civil engineers: Waste and resource management*, 159, 65-72.
- Osmani, M., Glass, J. & Price, A. (2007). Architects' perspectives on construction waste reduction by design. *Waste Management*, 28(7), 1147-1158.
- Ohno, T. (1988). *Toyota production system: Beyond large-scale production*, Cambridge, Mass.: Productivity Press.
- Pinto, T. P. & Agopayan, V. (1994). Construction waste as raw materials for low-cost construction products, Sustainable construction. In C. J. Kibert (Ed.), *Procedures of first Conference of CIB TG 16*. Centre for Construction and Environment. Gainesville, Florida. 335-342.
- Skoyles, E. R. (1976). Materials wastage – a misuse of resources. *Building Research and Practice*, 4(4), 232.
- Western Australian Local Government Association (WALGA). (2013). *Western Australian local government use of recycled construction and demolition materials*. Western Australia. Retrieved from: http://www.wastenet.net.au/assets/documents/content/information/cd_report_feb_2013.pdf