Recycled materials in pavement construction

A business case for councils to use local recycled materials as a supplement in pavement construction

Updated September 2014
Background

The emergence of recycled material as a viable product in pavement construction introduces an opportunity for councils to manage the future cost of road pavement maintenance and construction. Recycled crushed concrete, rock, stone, asphalt, brick and glass fines now compete with traditional virgin aggregate and sand extracted from quarries, on criteria of quality, price and availability, while offering many long term environmental benefits associated with using recycled product.

Reports of quarry material price increases of up to 70% in New South Wales, due to shortages of quarry material near Sydney, have sparked concern that the Victorian market could face similar increases.

In Victoria, viable locations for future quarries are becoming increasingly constrained as regional development moves into areas of known virgin resources. Continued demand for pavement materials will inevitably exhaust the supply for existing quarries, forcing the supply of Victorian quarry resources to move further away from demand – much like the circumstances in New South Wales where the increased cost of haulage greatly impacted prices for virgin materials.

This business case presents the competitiveness of local recycled materials as a supplement for traditional quarry materials in road pavement. Recommendations for councils to procure local recycled materials for road pavement construction are also provided.

Understanding the business case

There is a viable business case for councils to use local recycled materials as a supplement to virgin materials in pavement construction, based on and subject to the dimensions of quality, price and availability.

Quality

Recycled materials perform as well as traditional quarry materials

VicRoads specifications for application of recycled pavement materials are developed through robust scientific testing and trials. This ensures that their use is in appropriate low risk sub base and that VicRoads accredited recycled products are of excellent quality and performance.

A list of VicRoads accredited recycled product suppliers is available in the VicRoads Code of Practice: Management of Quarry Reference Specimens (RC 500.3).

https://www.vicroads.vic.gov.au/~/media/files/technicaldocuments/codes%20of%20prac/code%20of%20practice%20rc%2050003%20management%20of%20quarry%20reference%20specimens.ashx

False perceptions, about the quality of recycled materials, exist at the local government level (and beyond) and need to be overcome in order for recycled materials to compete fairly. At a minimum, councils should ensure that Section 820 and 821 (http://webapps.vicroads.vic.gov.au/VRNE/csdspeci.nsf) of the VicRoads specification are included in road design and procurement documentation for contractors to choose from.

Price

Recycled materials can be cost competitive with quarry materials

The key components of the cost of pavement materials is the cost of production and the cost of haulage. The cost of production for recycled and quarry material is similar, with recycled materials often costing less to produce. However, the cost of haulage is a significant component of delivered cost (due to the materials bulk and weight) and is sensitive to the unique factors that govern the availability and location of materials for supply.

In areas of availability, local recycled materials are cost competitive with and often cheaper than quarry materials (whose prices have generally been trending upward over the past decade).
The impact of haulage on total cost of pavement construction

The haulage cost component for both quarry materials and recycled materials can be seen by the change in price as a project location (points 1 and 2 on the diagram) moves closer or further away from each material source.

The relationship of delivered cost to geographical location of source material and potential location of project shows that there are regions where prices are expected to be competitive.
Availability
Access to recycled materials is project specific

Virgin quarry materials are limited by: geology, characterised by basalt reserves in the west and sand in east of Victoria; and the increasing difficulty for extractive industries to access potentially economic quarry sites due to growth planning and issues with approvals.

Recycled materials are limited by the location of recycling facilities and their proximity to a supply of suitable construction and demolition waste.

In general, the economic range of current recycled materials is limited to around 30 km due to the proximity of surrounding quarry resources, while quarry material can sometimes be hauled over 100 km to regional areas.

Mobile crushers can expand the reach of recycled materials

Mobile crushers have emerged as a technology that could benefit regional recycling. They can reduce the cost of haulage associated with either transporting waste feedstock to a recycling plant (by moving the crusher to the source of feedstock waste) or from transporting recycled material from the crusher to the project site (by moving the crusher to the project site). This is especially useful for small deposits of recovered construction material across a number of regional transfer station sites. Crushing allows use on site for small local projects, mass reduction and/or opportunity to transport and consolidate for larger projects.

To alleviate capital requirements and project-to-project type usage of mobile crushers, a possible solution could be to establish a share arrangement between regional councils (e.g. by waste management groups).

Pavement material resource map of Victoria

Note: the regions outlined in this document align with the Municipal Association of Victoria’s engagement with local councils not the waste management group regions.

Refer to pages 7–13 for maps of pavement material resources by region.
Comparison of the location of quarries and recycling infrastructure by region

<table>
<thead>
<tr>
<th>Region</th>
<th>Virgin materials</th>
<th>Recycled materials</th>
</tr>
</thead>
<tbody>
<tr>
<td>Metropolitan Melbourne</td>
<td></td>
<td>The western region and down toward Geelong is well serviced with quarry material. But much of this material is required to supplement the other regions.</td>
</tr>
<tr>
<td>West of Melbourne</td>
<td>The western region and down toward Geelong is well serviced with quarry material. But much of this material is required to supplement the other regions.</td>
<td>Over 20 Construction and Demolition (C&amp;D) recycling facilities operate in metropolitan Melbourne. These facilities are mainly located in the outer regions where it is economic to operate (i.e. where facilities can be built and located in reasonable proximity to construction and demolition activity).</td>
</tr>
<tr>
<td>North of Melbourne</td>
<td>Existing quarry resources in northern Melbourne are starting to exhaust; with those areas held for extractive industries (i.e. extractive interest areas) are more likely to become used for housing.</td>
<td>Facilities are mainly clustered in the west and south east of Melbourne, with a handful of facilities in the north and south east.</td>
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<tr>
<td>South of Melbourne</td>
<td>There is generally no quarried rock in the south of metropolitan Melbourne (where mainly sand exists).</td>
<td></td>
</tr>
<tr>
<td>East of Melbourne</td>
<td>While there is reasonable supply at present, existing quarries in the east (mainly sand) are rapidly nearing the end of life, with some having less than five years left. This high demand is due to growth in Pakenham and Berwick areas.</td>
<td></td>
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<td>Regional Victoria</td>
<td></td>
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<tr>
<td>Central</td>
<td>There is strong availability of clay and basalt towards Geelong and stretching north east to Ballarat (as identified in extensive extractive industry interest areas).</td>
<td>The Geelong area is reasonably well serviced by at least four C&amp;D recycling facilities, while at least two facilities operate in Ballarat.</td>
</tr>
<tr>
<td>South west</td>
<td>Some smallish quarries exist in the region, however the construction of wind farms – some of which require access tracks up to one metre thick to take the weight of the cranes – could exhaust these quarry resources.</td>
<td>C&amp;D recycling infrastructure in the south west of Victoria is very limited, with no facilities identified in the Statewide Waste and Resource Recovery Infrastructure (SWRRIP) data (Sustainability Victoria, 2013).</td>
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<td>North west</td>
<td>Supply in this region is good as there is little shortage due to an abundance of basalt, combined with low competing demand for quarry materials for construction projects</td>
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<td>North (Loddon Campaspe)</td>
<td>Supply in this region is reasonable due to the combination of existing basalt and relatively low competing demand for quarry materials for construction projects.</td>
<td>C&amp;D recycling facilities are scattered throughout the regions most populated areas (as identified by SWRRIP data Sustainability Victoria, 2013). Facilities are located in Bendigo, Echuca and Dunolly.</td>
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<td>North east</td>
<td>Some quarry materials are available in the western part of the region however quarried rock is not available in the north-east direction.</td>
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<td>East (Gippsland)</td>
<td>Quarried rock material is not available as sand dominates the geology of the Gippsland region (and is available in abundance).</td>
<td>C&amp;D recycling facilities are scattered throughout the regions most populated areas (as identified by SWRRIP data Sustainability Victoria, 2013). This includes the Latrobe Valley and Bairnsdale, while single facilities are also identified near Neerim and Wonthaggi.</td>
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The business case for using recycled materials is expected to strengthen in the future:

› as the availability of virgin materials from existing quarries becomes exhausted, and where the location of viable future quarry sites move further away from demand (i.e. the location of new pavement and maintenance works)
› if the location of recycling infrastructure and local supply of waste materials becomes more dispersed, particularly in regional areas.

Long-term benefits of using recycled materials in pavement construction

Beyond the fundamental and immediate economic case, the use of recycled materials offer a range of long-term benefits including:

› reduced impact on the environment through efficient use of extractive industries (i.e. natural resources)
› reduced waste to landfill (and increased life of local landfill facilitates)
› reduced energy required to produce pavement materials. Recycled materials are less energy intensive to produce than quarry materials
› some alleviation of conflict over use of land in regional growth planning.

VicRoads specifications

VicRoads is a national leader in the use of recycled materials in pavement construction and take an equal opportunity approach to specification that is intended to allow contractors to choose between recycled or virgin quarry materials (i.e. based on price and availability).

Relevant VicRoads specifications and technical notes concerning the use of quarry and recycled materials in pavement design include:

› VicRoads Specification 2011
  – Section 812: Crushed rock for pavement base and sub-base
  – Section 820: Crushed concrete for pavement sub-base and light duty base
  – Section 821: Cementitious treated crushed concrete for pavement sub-base
› VicRoads Technical Note 107: Use of recycled materials for road construction

If you have any questions on the quality and performance of recycled materials in pavement construction contact Graeme Newman, VicRoads Quarry Materials Specialist on 0407 102 549.

Recommendations for councils

At a minimum, council’s should begin to better understand their current use, potential use and barriers to greater uptake of recycled materials in their pavement construction and maintenance programs. This approach may include the following:

› Understand your pavement needs and if there is opportunities to use recycled material.
› Commit to use of recycled material which meets specifications as a viable alternative to virgin quarry material. This may be through a formal purchasing policy.
› Investigate your current use of, availability and potential barriers for recycled materials in your council. This may include:
  – reviewing the locations of quarry and recycled material suppliers in and around your council area
  – requiring contractors to report their use of recycled materials in projects (to help set a baseline)
  – developing a strategy to increase the overall use of recycled materials by addressing barriers and identifying projects where higher proportions of recycled content are suitable (e.g. for low-risk applications).
› Meet with your local recycled material suppliers to discuss your needs and their products.
› Discuss the benefits of using recycled materials in pavement construction with your contractors.
› Include sections 820 and 821 of the VicRoads specification in road design and procurement documentation to provide contractors the option to use them.

Councils with a local supply of recycled material should be supplementing virgin aggregate with recycled material in Class 2, 3 and 4 pavement sub bases, and aim to use at least 20% total recycled materials across all their pavement projects.
Recycled materials in pavement construction

Pavement material resources by region

Metropolitan

Existing quarry resources in northern Melbourne are starting to exhaust; with those areas held for extractive industries (i.e. extractive interest areas) more likely to become used for housing.

There is generally no quarried rock in the south of metropolitan Melbourne (where mainly sand exists).

While there is reasonable supply at present, existing quarries in the east (mainly sand) are rapidly nearing the end of life, with some having less than five years left. This high demand is due to growth in Pakenham and Berwick area.

The western region and down toward Geelong is well serviced with quarry material. But much of this material is required to supplement the other regions.

Over 20 C&D recycling facilities operate in metropolitan Melbourne. These facilities are mainly located in the outer regions where it is economic to operate (i.e. where facilities can be built and located in reasonable proximity to construction and demolition activity).

Facilities are mainly clustered in the west and south east of Melbourne, with a handful of facilities in the north and south.

Metropolitan Melbourne: Pavement materials resource map

C&D recycling facility

Current extractive industry tenement

Quarry or mine area (existing)

Extractive industry interest area
Central

Ballarat, Golden Plains, Hepburn, Moorabool, Pyrenees, Queenscliffe, Surf Coast

In the central region there is strong availability of clay and basalt towards Geelong and stretching north east to Ballarat (as identified in extensive extractive industry interest areas).

The Geelong area is reasonably well serviced by at least four C&D recycling facilities, while at least two facilities operate in Ballarat.

Central: Pavement materials resource map
Gippsland

Bass Coast, Baw Baw, East Gippsland, South Gippsland, Wellington, Latrobe

Quarried rock material is not available as sand dominates the geology of the Gippsland region (and is available in abundance).

C&D recycling facilities are scattered throughout the regions most populated areas (as identified by SWRRIP data, Sustainability Victoria, 2013). This includes the Latrobe Valley and Bairnsdale, while single facilities are also identified near Neerim and Wonthaggi.

Gippsland: Pavement materials resource map
Loddon Campaspe

_Campaspe, Central Goldfields, Bendigo, Gannawarra, Hepburn, Loddon, Macedon Ranges, Moira, Mount Alexander_

The supply of virgin quarry material in the Loddon Campaspe region is reasonable due to the combination of existing basalt and relatively low competing demand for quarry materials for construction projects.

C&D recycling facilities are scattered throughout the regions most populated areas (as identified by SWRRIP data, Sustainability Victoria, 2013). Facilities are located in Bendigo, Echuca and Dunolly.
North east

Alpine, Benalla, Indigo, Mansfield, Mitchell, Murrindindi, Strathbogie, Towong, Shepparton, Wangaratta, Wodonga

In the north east some quarry materials are available in the western part of the region however quarried rock is not available in the north-east direction.

C&D recycling facilities are scattered throughout the regions most populated areas (as identified by SWRRIP data Sustainability Victoria, 2013). Facilities are located in Wodonga, Shepparton and Mansfield.
North west

Buloke, Hindmarsh, Mildura, Northern Grampians, Swan Hill, West Wimmera, Yarriambiack

The supply of virgin quarry material in the north west region is good as there is little shortage due to an abundance of basalt, combined with low competing demand for quarry materials for construction projects.

C&D recycling infrastructure in the north west of Victoria is very limited, with no facilities identified in the SWRRIP data (Sustainability Victoria, 2013).

North west: Pavement materials resource map
South west

Ararat, Colac Otway, Corangamite, Glenelg, Moyne, Southern Grampians, Warrnambool

Some small quarries exist in the south west, however the construction of wind farms – some of which require access tracks up to one metre thick to take the weight of the cranes – could exhaust these quarry resources.

C&D recycling infrastructure in the south west of Victoria is very limited, with no facilities identified in the SWRRIP data (Sustainability Victoria, 2013).

South west: Pavement materials resource map
Construction and demolition recyclers in Victoria

**Metropolitan Melbourne**
- A&R Second-hand Dealers
- Alex Fraser (north, south-east and west)
- Altona North Recycling
- Anglo Australian Demolition Co
- Apex Waste Collection
- Beaver Bricks
- Boral
- Budget Demolition & Recyclers
- Canterbury Courtyard & Roofing
- Chadwick Demolition
- City Circle Demolitions (south-east and west)
- Clayton Brick & Timber Salvage/Diver Demolitions
- Delta Group
- Eastern Recycling & Waste Transfer Centre
- Ecobricks (east and west)
- Konstruct Recycling
- Melbourne Recycling Centres
- Paddy's Bricks
- SITA
- Steptoe's Renovation Supplies
- Sunshine Groupe

**Gippsland**
- A1 Concrete Recycling
- Building Bitz
- Drouin Waste Recyclers & Waste Transfer Station
- G&J Crosby Contractors
- Gippsland Concrete Recyclers
- Neerim South Quarry & Concrete recycling
- Traralgon Concrete products
- Whelan's Earthmoving

**Loddon Campaspe**
- A&R Second-hand Dealers
- Hopley
- Macca's Demolition & Secondhand Building Materials

**North east**
- Crowbar Demolitions
- Delaney AP & Co
- Jackson's Earth Moving and Concrete Recyclers
- Mansfield Construction Pty Ltd

Refer to VicRoads Code of Practice: Management of Quarry Reference Specimens (RC 500.3) for a list of VicRoads accredited suppliers.

https://www.vicroads.vic.gov.au/~/media/files/technicaldocuments/codes%20of%20practice/code%20of%20practice%20rc%2050003%20%20management%20of%20quarry%20reference%20specimens.ashx

**Central**

**Geelong area**
- Bernie Leen & Sons
- Geelong Restorers Barn
- Local Mix Concrete
- Regional Recycle

**Ballarat area**
- Ballarat Concrete Recycling
- Chris Bev Pty Ltd
- David Eldridge Pty Ltd

This business case has been developed in partnership by NetBalance, Sustainability Victoria, the Municipal Association of Victoria and VicRoads.