

RECYCLED CRUSHED GLASS



WHAT IS RECYCLED CRUSHED GLASS?

Recycled Crushed Glass (RCG) is a product of manufacturing and consumer mixed-glass waste and is sourced mainly from glass food and beverage containers. Waste glass is processed and crushed to produce a sand-sized material, with a typical maximum size of 4.75 mm.

WHAT ARE THE BENEFITS OF USING RECYCLED CRUSHED GLASS?

The benefits of using recycled crushed glass in road and rail infrastructure are as follows:

- **Environmental benefits**
 - Recycling glass into transport infrastructure reduces dependency on natural aggregate resources and reduces the amount of waste going to landfill. It is especially useful in locations where there is a lack of sand-sized components of natural aggregates, reducing the need for materials to be imported across considerable distances.
- **Performance benefits**
 - RCG has comparable engineering properties to those of natural aggregates, making it suitable for utilisation in transport infrastructure. It is ideal for use as part of a blend within poor quality soils, unbound pavement layers and granular applications, due to its insensitivity to variations in moisture. RCG can improve marginal granular materials' performance by adjusting gradations.

The use of recycled glass as replacement sand has some perceived safety concerns. However, research has shown that recycled glass sand has no more risk in terms of breathing in crystalline silica than virgin sand does at the beach. Risk of abrasion has also been registered as unlikely because of its very small particle sizes. This low risk can be mitigated with personal protective equipment (PPE). RCG can also pose an odour issue and in some cases can be washed to mitigate this.

WHERE IS IT USED?

In road infrastructure, RCG may be used as a partial replacement for the fine aggregate component of asphalt mixtures, or as part of a granular blend in road base and subbase. RCG can be used as an aggregate supplement along with recycled concrete as a capping layer in the railway track formation. It can be used as a bedding and backfill material, in certain drainage applications, within landscaping and as part of a granular blend for embankment fill. Other applications in the transport construction sector include using RCG as a partial fine aggregate substitution in non-structural concrete and concrete pavement applications.

HOW MUCH CAN BE USED?

In road applications, RCG can be used up to 100% by mass as bedding and backfill material and in certain drainage works and as a drainage medium; up to 50% and 20% by mass in granular subbase and bases respectively; up to 10% by mass in asphalt bases; and up to 5% by mass in asphalt wearing course. RCG can be incorporated in concrete pavements by up to 15% by mass of the fine aggregate component.

Research suggests that RCG can be blended up to 40% by mass with recycled concrete aggregates for use as a capping material in railway structures, while up to 20% by mass RCG can be incorporated in non-structural concrete.

WHAT OPPORTUNITIES ARE THERE FOR IMPROVING ADOPTION?

Many opportunities exist for using RCG within transport infrastructure, with several specifications already allowing for its use and more under development.

The key challenges for adopting RCG into road and rail infrastructure are related to:

- Awareness of how and where RCG can be used within transport infrastructure applications.
- The availability of and demand for RCG depending on local recycling infrastructure, which varies considerably by geographical location.
- Contamination potentially affecting the quality of the processed RCG. This can affect the performance of the infrastructure containing it, especially for RCG used in concrete.

These challenges can be overcome by:

- Sharing and disseminating knowledge on best practice use of RCG within transport infrastructure.
- Investing in fit-for-purpose recycling facilities, so RCG can consistently meet engineering requirements.
- Standardising processing protocols to produce an RCG supply of consistent quality. For certain end applications, such as use in concrete, washing before use is advisable.



[Development of a Specification for Recycled Crushed Glass as a Sand Aggregate Replacement](#)

RECYCLED CRUSHED GLASS: VIC



WESTERN ROADS UPGRADE

The Victorian Government's Western Roads Upgrade used 190 million bottles of recycled glass in a project that upgraded eight major roads, resurfaced 37 arterial roads and strengthened seven structures, including several bridges, a culvert and a pedestrian overpass. Sourced from Alex Fraser's glass processing plant in Laverton North, the glass originated from items such as industrial offcuts and food and beverage containers that cannot be turned back into glass products. Once processed, it is like coarse sand and is free of contaminants, with particles all under 4.75 mm. A key benefit of this application was the proximity to the source of the recycled material, reducing the need for long haulage distances to source materials. Approximately 785 truck movements were saved in the project, alongside 1,729 tonnes of carbon emissions, 264,800 tonnes of materials diverted from landfill and a reduction of 288,338 tonnes in natural resources. The carbon footprint of the project was cut by an estimated 65% due to the use of recycled materials.

Other benefits of the project include improved road safety for pedestrians and cyclists, and routes for priority trucks.

DINGLEY BYPASS

Recycled materials can often be used in tandem and the Dingley Bypass is a great example of this. The project used a mix of recycled materials, including crushed concrete and recycled crushed glass as a sand replacement. This project saw savings of 23,000 tonnes of material, 770 fewer truck loads and 1,695 tonnes of carbon emission reduction. More than 269,000 tonnes of sustainable construction materials were used along the 6.4 km project.

 [Dingley Bypass - Project Profile](#)

 [Western Roads Upgrade](#)



LOCATIONS

NATIONAL TRANSPORT RESEARCH
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PORT MELBOURNE, VIC 3207

OFFICES IN:
BRISBANE, SYDNEY, ADELAIDE, PERTH, CANBERRA



RECYCLED CRUSHED GLASS: CANTERBURY BANKSTOWN, NSW



The increased use of recycled crushed glass (RCG) was investigated as part of City of Canterbury Bankstown's rehabilitation program. Recycled crushed concrete (CC) was identified as a source material for use in subbase and road base applications. This material was characterised by ARRB in their laboratory. This was then blended with RCG to optimise its resistance to permanent deformation. It was identified that the addition of RCG to CC could improve gradation, resulting in easier compaction and improved permanent deformation resistance. As a result of this, testing an optimised blend of 70% CC/30% RCG was chosen for production scale-up, with a view to implementing field trials.

ARRB engaged Fulton Hogan to look at the feasibility of scaling-up the blend through plant production for the planned field trial. Fulton Hogan blended the RCG and CC materials using an asphalt batch plant, then laid and compacted some material in a test pad in their yard.

In February 2022, a trial section was constructed as part of rehabilitation works on Marion Street, Georges Hall, near Bankstown Aerodrome. This work involved laying an approximately 270 m section with approximately 460 tonnes of the 70% CC/30% RCG blend being incorporated into a 200 mm thick subbase. This work was undertaken for City of Canterbury Bankstown by ARRB in partnership with Fulton Hogan, who were responsible for scale-up and construction. ARRB will be undertaking performance monitoring on this section to assess its long-term suitability.

A grant from EPA NSW, under the Civil Construction Market Program, enabled City of Canterbury Bankstown to undertake this work to gain more sustainable outcomes as part of its rehabilitation program.



[Traffic Test for Crumb Rubber Asphalt mixes](#)



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RECYCLED CRUSHED GLASS: WILLIAMSTOWN NORTH, VIC



Recycled crushed glass (RCG) is emerging as a suitable replacement material for virgin sand. A first major use was at the 2019 Kororoit Creek Road Level Crossing Removal Project in Williamstown North. This trial saw 900 tonnes of recycled glass sand replacing virgin sand, diverting waste from landfill and reducing the need for virgin materials. The recycled glass sand was used as a bedding material for communications and power cables.

The trial also saw the development of a recycled glass sand specification by MTM, in collaboration with the Level Crossing Removal Project. The material is approved for use in certain bedding applications, with the specification outlining requirements for source, particle size, quality, handling and storage. Other uses of recycled glass sand can be in drainage, pipe bedding, concrete and road construction, such as in asphalt.

The trial site is part of Victoria's Principal Freight Network and a major throughfare in the west, with more than 22,000 cars passing through to Laverton, Altona and surrounds daily.



[Metro trains specifications include recycled materials](#)



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GRANULAR MATERIALS: WHITTLESEA, VIC



City of Whittlesea, Department of Transport Victoria and Repurpose It, have worked together to utilise a Type A capping material that is 100% recycled. The material can be used instead of virgin clay. Type A capping is a layer of material that is placed below a pavement subbase to minimise changes in moisture content and protect poor quality subgrades.

This was made possible by Repurpose It's new blending plant, which allows value creation from otherwise contaminated materials. There are approximately 160,000 sites around Australia that have soil pollution from as many as 75,000 contaminants. This includes chemicals and municipal waste, meaning the soil cannot be reused and is instead sent to landfill. The blending plant processes these contaminated soils, returning them to suitably decontaminated levels for reuse. By extension it reduces the volume sent to landfill. The plant can also process clay, glass, sands, aggregates, water and cement. This creates a wide variety of products that meet relevant standards and specifications for reuse in engineering applications.

Another of Whittlesea's partnerships with Repurpose It is a project using recycled glass in road base, supported by Sustainability Victoria and in partnership with Metro Asphalt. The project has a road base produced from 97% recycled materials, including glass sourced from local recycling bins as a sand replacement. Performance will be monitored against a control section of road constructed with conventional materials.



[Collaborating for change: Repurpose It's partnership with Whittlesea Council and Vic Roads](#)



[Planting the seed for change: New Blending Plant to repurpose contaminated soil and construction materials](#)



[Epping's Yale Drive to be Upgraded with Recycled Glass](#)



[Yale Drive Road Resurfacing](#)



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