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Recycled Materials in Road Infrastructure

Reference Guide – August 2024

An initiative of Victoria's Big Build

VICTORIA'S BIG BUILD

VICTORIA State Government

Contents

1. Introduction

The Reference Guide for *Recycled Materials in Road Infrastructure* (guide) is part of a strategic government commitment to support greater use of recycled materials in construction.

The guide provides a summary of current industry standards, specifications and documents from the Department of Transport and Planning (DTP) and Australian standards, specifications and clauses that allow the use of recycled materials in pavement design and other road infrastructure applications.

Victoria's Big Build is continuing to deliver dozens of major road projects, which provides an invaluable opportunity to change how waste is used in Victoria and increase the use of recycled and reused materials in transport infrastructure construction.

The guide builds on the considerable work already undertaken across government to encourage the use of recycled materials in construction and more broadly, including the:

- Statewide Waste and Resource Recovery Infrastructure Plan (Sustainability Victoria)
- Recycling Victoria Strategic Plan (Department of Energy, Environment and Climate Action)
- Extractive Resources Strategy (Department of Jobs, Precincts and Regions)
- Social Procurement Framework (Buying for Victoria)
- Recycling and Resource Recovery Infrastructure Evidence Base Report (Infrastructure Victoria)

1.1 How to use these guidelines

This guide is intended for use by designers, contractors, asset owners and others working on major road infrastructure projects across all project phases.

This guide can be utilised to quickly identify what recycled materials can be used in certain road infrastructure applications.

For suppliers, the guide can also be used to determine potential areas of development and demand.

Information in this guide has been drawn from DTP documents as at the time of publishing and should be read in conjunction with the most up to date referenced standards, codes of practice and technical notes.

This guide is not a replacement for the current DTP standards. This quick–reference guide demonstrates the possibilities for using recycled materials in line with current design and construction standards.

Referral must always be made to standards, specifications and contract documents.

1.2 Using recycled materials

Recycled crushed concrete (CC), crushed brick (CB), glass, steel, reclaimed asphalt pavement (RAP) and crumb rubber (CR) products are commonly used in construction to supplement traditional virgin aggregate and sand products extracted from quarries.

These materials compete well in terms of quality, price and availability and offer numerous long term environmental and social benefits.

Specifications for the use of recycled products in road infrastructure are developed through robust assessment processes. This ensures that they are used in appropriate applications and that DTP accredited recycled products meet the required quality and performance criteria.

2. Reference Documents

2.1 Department of Transport and Planning Documents

The current DTP standards, codes of practice and technical notes used in this guide are shown in Section A.1 of Appendix A. These documents are the primary reference for allowances and material specification requirements. These documents are available at www.vicroads.vic.gov.au/business-and-industry/technical-publications

3. General Considerations

The following points should be taken into account when considering the use of recycled material in the construction of road infrastructure:

Environmental management:

- Requirements of Sections 176 and Section 177 must be met.
- All activities involving recycled materials (i.e. sourcing, transporting, processing and placing) must meet the relevant statutory and regulatory requirements.

Whole-of-Life (WoL) carbon emissions:

- Traditional quarried materials often have a large embedded carbon cost from production, to construction, to final recycling/disposal.
- Use of recycled materials to replace or supplement traditional quarried materials may reduce WoL carbon emissions, but consideration should be given to all processing/recycling requirements and transport distances and their associated emissions (e.g. collection, cleaning, processing).

Sourcing/Supply constraints:

- Selection and use of recycled materials must consider the source/supply availability of such materials.
- Sourcing restrictions may be due to project location (high cost of material transport) and/or market availability.
  - Existing markets (e.g. CC, RAP and CR) are readily available and commonly used to supplement/compliment traditional quarried materials in road infrastructure construction.
  - Emerging markets (e.g. recycled plastics) are less developed. This is due to a lack of data leading to uncertainty around their impact on the environment, health and safety, asset performance and their reuse as part of a circular economy; and/or a lack of consistent and reliable material supply.

Waste management hierarchy:

- Ideally, production of waste from road infrastructure projects should be avoided, however, this is often not practical. In cases where avoiding waste material generation is not feasible, it is important to minimise waste production, and to reuse or recycle valuable construction resources wherever possible.
- This document provides support for addressing the 'reuse' and 'recycle' steps of the Waste Management Hierarchy (*Figure 1*).

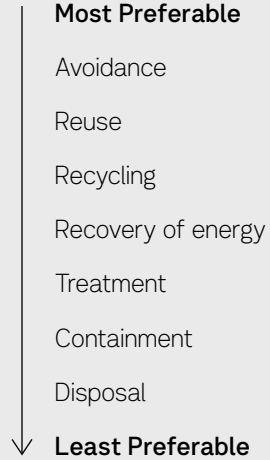


Figure 1 – Waste Hierarchy (Infrastructure Victoria, 2019)

3.1 Recycled Material Sources and Usage

Table 1 provides a summary of the current and emerging recycled material sources and their current areas of use.

Table 1 – Recycled material sources and general applications for use

Recycled material	Sources	Processing	General applications*
Crushed Concrete (CC) 	▪ Demolition works ▪ Returned loads ▪ Other infrastructure construction activities	▪ Removal of contaminants, followed by crushing and screening	▪ Class 2, 3 and 4 crushed rock replacement/supplement in unbound granular pavements ▪ Class 3 crushed rock, and cement–treated crushed rock (replacement for light duty subbases) ▪ Class 3 or 4 crushed rock replacement in miscellaneous applications (e.g. footpath bedding, kerbs, channels, culverts and culvert backfill) ▪ Retaining walls and façades ▪ Drainage systems ▪ Platforms
Recycled Crushed Glass (RCG) 	▪ Container glass cullet	▪ Removal of contaminants, followed by crushing to required gradation (e.g. glass fines)	▪ Glass fines can be used: – as a replacement for sand in intermediate and base course asphalt mixes, and some wearing course mixes – in general concrete paving – as a granular filter material for subsurface drains – as bedding material for conduits for Intelligent Transport Systems and Electrical Devices ▪ Recycled crushed glass as supplementary material in crushed rock mixes ▪ Pavement surface treatments and reflective road markings

**For more information about ancillary and rail applications, refer to the ecologiQ Rail and Ancillary Infrastructure Reference Guides.*

Recycled material	Sources	Processing	General applications*
In situ recycled pavement materials	▪ Existing pavement	▪ In situ recycling and stabilisation	▪ Pavement construction and rehabilitation
Ex situ recycled pavement materials	▪ Existing pavement	▪ Ex situ recycling and stabilisation	▪ Pavement construction and rehabilitation
Reclaimed Asphalt Pavement (RAP) 	▪ Removal of asphalt from existing road pavement	▪ Crushing and screening	▪ Recycled into new asphalt or other approved materials (e.g. some crushed rock mixes) dependent on the amount of RAP and mix type (see Code of Practice RC 500.01 and the 400 Series Standard Sections)
Crumb Rubber (CR) 	▪ End-of-life tyres	▪ Ambient mechanical grinding, or ▪ Cryogenic mechanical processing (less common)	▪ Spray sealing ▪ Some asphalt mixes ▪ Shared User Paths ▪ Permeable Paving ▪ Miscellaneous roadside applications (e.g. landscaping, retaining walls, playgrounds) ▪ Traffic calming devices (e.g. bollards, wheel stops, speed humps)
Crushed Brick (CB) 	▪ Construction and demolition works	▪ Removal of contaminants, followed by crushing and screening	▪ Supplementary material for some crushed rock blends and cementitious treated pavements (allowable percentages are specified in Code of Practice RC 500.02

**For more information about ancillary and rail applications, refer to the ecologiQ Rail and Ancillary Infrastructure Reference Guides.*

Recycled material	Sources	Processing	General applications*
Supplementary Cementitious Materials (SCMs) 	▪ Waste by-products including fly ash (FA), ground granulated blast furnace slag (GGBFS) and amorphous silica	▪ Treated to comply with AS 3582.1, AS 3582.2 and AS3582.3, respectively	▪ SCMs are used to replace a certain proportion of cement in concrete mixes to improve workability, strength and durability ▪ Can be used in binders for pavement stabilisation, or as an additive to mitigate alkali-silica reactions in aggregate
Slag aggregate 	▪ By-product of steelmaking – either basic oxygen steel (BOS) slag, or electric arc furnace (EAF) slag	▪ Slag aggregate can be produced from either the refining of pig-iron in an oxygen converter or, by melting scrap steel	▪ Fill material (Types A, B, and C) in earthworks (Section 204) ▪ Granular filter material in subsurface drainage (Section 702) ▪ In crushed rock mix for lower trafficked base and subbase (Section 813) ▪ In crushed rock mix (Code of Practice RC 500.02)
Steel 	▪ Reclaimed (scrap) steel	▪ Melted in an EAF and cast into sections for rolling into products	▪ Reinforcing bars ▪ Steel mesh ▪ Steel rod ▪ Wire ▪ Road safety barriers, guardrails and retaining walls ▪ Energy Absorbing Bollards (EABs) ▪ Signage and lighting posts and foundations ▪ Roadside furniture and amenities (e.g. benches and bike racks)

**For more information about ancillary and rail applications, refer to the ecologiQ Rail and Ancillary Infrastructure Reference Guides.*

Recycled material	Sources	Processing	General applications*
Plastic 	▪ Commercial, industrial and municipal waste	▪ Sorted into plastic types/categories ▪ Shredded and granulated ▪ Cleaned/washed ▪ Dried, decontaminated and pelletised ▪ Reprocessed/reformed into recycled products	▪ Service pits ▪ Noise walls, retaining walls and façades ▪ Asphalt ▪ Drainage pipes ▪ Geotextiles ▪ Macro Synthetic Fibre concrete reinforcement ▪ Aggregate replacement in concrete ▪ Barrier end treatments and bollards ▪ Roadside furniture (e.g. pavement markings, wheel stops) ▪ Urban design and landscaping (e.g. fencing, signs, boardwalks and decking) ▪ Traffic management devices (e.g. bollards and cones)
Tyre Derived Aggregate 	▪ End-of-life tyres	▪ Mechanical grinding	▪ Lightweight embankment fill ▪ Retaining wall fill ▪ Drainage layers

**For more information about ancillary and rail applications, refer to the ecologiQ Rail and Ancillary Infrastructure Reference Guides.*

4. Specified Material Applications

The current specified applications for recycled materials are outlined in Table 2 and 3, which illustrate what recycled material categories can be used, to some degree, within an overarching application.

For descriptions of various material categories, as referenced in these guidelines, refer to *Table B.1 – Material Descriptions in Appendix B*.

Please note that Table 2 is a quick reference table that outlines the areas of opportunity for recycled material use. In some instances, recycled materials may only be used as supplementary materials, or in specific areas of use.

For extra information on the degree of use, and specific use areas, refer to Table 3 which summarises the allowable limits of these materials, and directs to relevant DTP standards, codes of practice and technical notes.

Table 2 - Opportunities for recycled materials

Material application	Material type/ product	CC	RAP	RCG	CB	CR	Slag aggregate	FA/GGBFS	Plastic
Stabilisation (Mechanical[1])	Formation and pavement[2]	✓	✓	✓	✓	✗	✓	✗	✗[3]
Stabilisation (by adding binder(s)[4])		✗	✗	✗	✗	✗	✗	✓	✗
Pavements – formation	Class 1 Crushed Rock	✗	✓	✓	✓	✗	✓	✗	✗
	Class 2 Crushed Rock	✓	✓	✓	✓	✗	✓	✗	✗
	Class 3 Crushed Rock	✓	✓	✓	✓	✗	✓	✗	✗
	Class 4 Crushed Rock	✓	✓	✓	✓	✗	✓	✗	✗
	Type A, B & C Fill	✓	✓	✓	✓	✗	✓	✗	✗
Pavement* (Asphalt and Spray Seals)	Asphalt types L, N, H, SI, SG, SS & SF, & RGG asphalt	✗	✓	✓[5]	✗	✗	✓	✓	✓
	HBCRA and LTCRA	✗	✓[6]	✗	✗	✓	✓	✗	✓
	Seals – Conventional, HSS, XSS, SAM and SAMI	✗	✗	✗	✗	✓	✓[7]	✗	✗
	OGA	✗	✗	✗	✗	✓	✓	✓	✗
	SMA	✗	✗	✗	✗	✓	✓	✓	✗

**Refer to Appendix Table B.1 for full pavement type titles.*

Notes

1. *Improving the engineering properties (e.g. particle size distribution (PSD), plasticity and California bearing ratio (CBR)) of material by adding a granular material or geosynthetics.*
2. *In situ recycled materials (e.g. recycled pavement materials) can be used for in situ stabilisation.*
3. *Used in geosynthetics.*
4. *Improving the engineering properties of material by adding a single cementitious and/or bituminous binder or blend of binders.*
5. *RCG is permitted in dense graded wearing course mixes, and as a replacement for natural sand in structural mixes.*
6. *For LTCRA only.*
7. *Slag may be used in seals, however they require field validation, and are dependent on the source material and whether it is approved. Blends with other aggregates will require DTP approval.*

Material application	Material type/ product	CC	RAP	RCG	CB	CR	Slag aggregate	FA/GGBFS	Plastic
Subsurface drainage	Granular Filter Material	☒	☒	☑	☒	☒	☑	☒	☒
	Drainage Pipes	☒	☒	☒	☒	☒	☒	☑	☑
	Pits	☒	☒	☒	☒	☒	☒	☑	☑
Shared user paths, footpaths, edgings, etc.	General Concrete Paving	☑ [8]	☒	☑	☒	☒	☒	☑	☑
Structural concrete (e.g. bridges, retention systems, etc.)		☒	☒	☒	☒	☒	☒	☑	☑
Roadside	Noise Walls	☒	☒	☒	☒	☒	☒	☑	☑
	Fences	☒	☒	☑	☒	☒	☒	☑	☒

Notes

8. As a bedding material.

Table 3 – Allowable limits of recycled materials[1]

Material type/product	CC	RAP[2]	RCG	CB	CR	Slag aggregate	FA/GGBFS	Plastic	DTP reference documents[3]
Stabilisation (Mechanical) Subgrade[4]	☒	☒	☒	☒	☒	☒	☒	☒	N/A
Stabilisation (Mechanical) Formation (other than subgrade) and Pavement	Same as Class 1-4 Crushed Rock (supplementary materials) and Type A, B and C fills								Code of Practice RC 500.02 Section 801 Section 812 Section 813 Section 815 Technical Note TN 107
Stabilisation (by adding binder(s))	☒	☒	☒	☒	☒	☒	Refer to Table 5	☒	Refer to Table 5
Class 1 Crushed Rock[5]	☒	5%	5%	5%	☒	5%	☒	☒	Code of Practice RC 500.02 Section 801 Section 812 Section 813 Section 815 TN 107
Class 2 Crushed Rock[5]	10%	10%	10%	10%	☒	10%	☒	☒	
Class 3 Crushed Rock[5]	100%	15%	15%	15%	☒	15%	☒	☒	
Class 4 Crushed Rock[5]	100%	50%	50%	50%	☒	50%	☒	☒	
Lower Trafficked Base (Class LTB)	20%	20%	20%	20%	☒	20%	☒	☒	Section 813
Lower Trafficked Subbase (Class LTS)	50%	50%	50%	50%	☒	50%	☒	☒	
Type A, B and C fill	Refer to Section 204 – clause 204.04(e) up to 100%				☒	Refer to Section 204 – clause 204.04(e)	☒	☒	Section 204
Granular Filter Material	☒	☒	100%	☒	☒	100%	☒	☒	Section 702 TN 107

Material type/product	CC	RAP[2]	RCG	CB	CR	Slag aggregate	FA/GGBFS	Plastic	DTP reference documents[3]
Drainage Pipes	☒	☒	☒	☒	☒	☒	Content varies with concrete mix. Refer to Section 610	100%	Section 610 Section 701
Pits	☒	☒	☒	☒	☒	☒		100%	Section 610 Section 705
General Concrete Paving	100% (as bedding material)	☒	30% washed (replacement of the total mass of fine aggregate) 10% unwashed (replacement of the total mass of fine aggregate)	☒	☒	☒		As aggregate replacement or fibre, subject to approved mix design.	Section 610 Section 703 TN 107
Structural Concrete	☒	☒	☒	☒	☒	☒			Section 610
Asphalt — Type L	☒	25%	5%	☒	☒	For use in source rock aggregate – limits as per selected class of crushed rock	100% as filler	May be permitted in dense graded asphalt (excluding mixes containing polymer modified binders (PMB)), subject to approved mix design.	Code of Practice RC 500.01 Code of Practice RC 500.02 Section 405 Section 407 Section 801 Section 812 Section 815 TN 107
Asphalt — Type N	☒	10% when using C320 binder and 25% when using C170 binder	5%	☒	☒		100% as filler		
Asphalt — Type V	☒	15%	5%	☒	☒		100% as filler		
Asphalt — Type H	☒	20%	5%	☒	☒		100% as filler		
Asphalt — Type SI and SS	☒	30%	100% (as a sand replacement)	☒	☒		100% as filler		
Asphalt — Type SF	☒	40%	100% (as a sand replacement)	☒	☒		100% as filler		
Asphalt — RGG	☒	10%	☒	☒	☒		100% as filler		
Asphalt — HBCRA	☒	☒	☒	☒	2.5 – 3%		☒		Code of Practice RC 500.01 Section 421 Section 422 TN 107
Asphalt – LTCRA (dry mix)	☒	10% when using C320 binder and 25% when using C170 binder	☒	☒	Min 0.5% (10 mm and 14 mm mix sizes) and 0.6% (7 mm mix size)		☒		
Asphalt — LTCRA (wet mix)	☒	10% when using C320 binder and 25% when using C170 binder	☒	☒	As per selected binder		☒		

Material type/product	CC	RAP[2]	RCG	CB	CR	Slag aggregate	FA/GGBFS	Plastic	DTP reference documents[3]
Asphalt — OGA	☒	☒	☒	☒	Nominally up to 10% by weight of binder, subject to approved mix design	For use in source rock aggregate – limits as per selected class of crushed rock	As a filler	☒	ATS3110 Code of Practice RC 500.01 Section 404 Section 417 TN 107
Asphalt — SMA	☒	☒	☒	☒			100% as filler	☒	
Seal — Conventional	☒	☒	☒	☒	5%	100%	☒	☒	Section 408 Section 421 Section 422 TN 107
Seal — HSS	☒	☒	☒	☒	Min 9%		☒	☒	
Seal — XSS	☒	☒	☒	☒	Min 15% (S15RF), 18% (S45R)		☒	☒	
Seal — SAM	☒	☒	☒	☒	Min 15% (S15RF), 18% (S45R)		☒	☒	
Seal — SAMI	☒	☒	☒	☒	18% (S18RF)		☒	☒	
Roadside — Noise Walls	☒	☒	☒	☒	☒	☒	For concrete foundations, content varies with mix. Refer to Section 610	Up to 100%	Section 610 Section 766
Roadside — Fences	☒	☒	30% washed (replacement of the total mass of fine aggregate) 10% unwashed (replacement of the total mass of fine aggregate)	☒	☒	☒	For concrete attributes, content varies with mix. Refer to Section 610	☒	Section 610 Section 703 Section 707

1. Percentage limits are by mass of mix, except where binders are specified which are reported by mass of binder (binder types include S45R, S15RF and S18RF)
2. Refer to Table 4 for additional information of the inclusion of RAP in asphalt mixes
3. Standard Section Documents can be found at: http://webapps.vicroads.vic.gov.au/VRNE/csdspeci.nsf/l
4. The limits for recycled materials in mechanical stabilisation of subgrade depends on the subgrade soil type, e.g. expansive clay or sandy.
5. Supplementary material limits in crushed rock classes are considered total limits. Blends of multiple materials shall not exceed the limits outlined, combined, as a percentage of the mix.

Table 4 – Additional information for the inclusion of RAP in asphalt mixes

Allowable RAP content		
Mix type	**Max % Level 1**	**Max % Level 2[1]**
L	25%	
N	10% using C320 25% using C170	
H	15%	16 to 20%
SI & SS	15%	16 to 30%
SF	15%	16 to 40%
V	15%	

1. Level 2 RAP mixes, RAP binder characterisation and binder blend viscosity must be undertaken in accordance with Section 407.

Table 5 – Allowable limits of SCM

Material / product / mix type	FA	GGBFS	DTP reference documents[1]
Cementitious treated pavement subbase	30[2,3]	50[2,3] 90[3,4]	Section 306 Section 815
In situ stabilisation of pavements[5]	30[2,3]	50[2,3] 90[3,4]	Section 307
Stabilisation of earthworks	N/S[6]	90[3,4]	Section 290

1. Standard Section Documents can be found at: webapps.vicroads.vic.gov.au/VRNE/csdspeci.nsf/
2. In blended cement.
3. By mass of the total blended binder content.
4. In slag-lime blend.
5. Using recycled materials, such as fly ash as a partial/full replacement for lime (supplementary binder), in foamed bitumen stabilisation should be explored and must be in accordance with Section 308.
6. Allowed, but limit is not specified.

5. Emerging Materials

The potential for re-use and inclusion of other recycled materials is actively being pursued in the road construction industry.

Research, development and trials are being undertaken to better understand their possible uses in road construction and to determine future opportunities and additional materials for usage.

This section highlights some examples of emerging materials that have the potential for uptake and could be considered for infrastructure projects in Victoria, including on a trial basis.

5.1 Crumb Rubber

While the use of crumb rubber in sprayed seal surfacing is well established, there is significant potential to increase the use of crumb rubber in asphalt.

Research and development works are underway to develop and trial viable asphalt mixes containing crumb rubber. In addition, a nationwide crumb rubber modified binder specification (ATS3110) has been developed to facilitate increased use of mixes containing crumb rubber.

5.2 Tyre derived aggregate (TDA)

The use of TDA along with TDA/soil mixtures and whole scrap tyres is currently defined in international standard ASTM D6270-17 *Standard Practice for Use of Scrap Tires in Civil Engineering Applications*. The physical properties, testing, design considerations and leachate potential are outlined for TDA in applications such as lightweight embankment fill, retaining wall fill and drainage layers for roads.

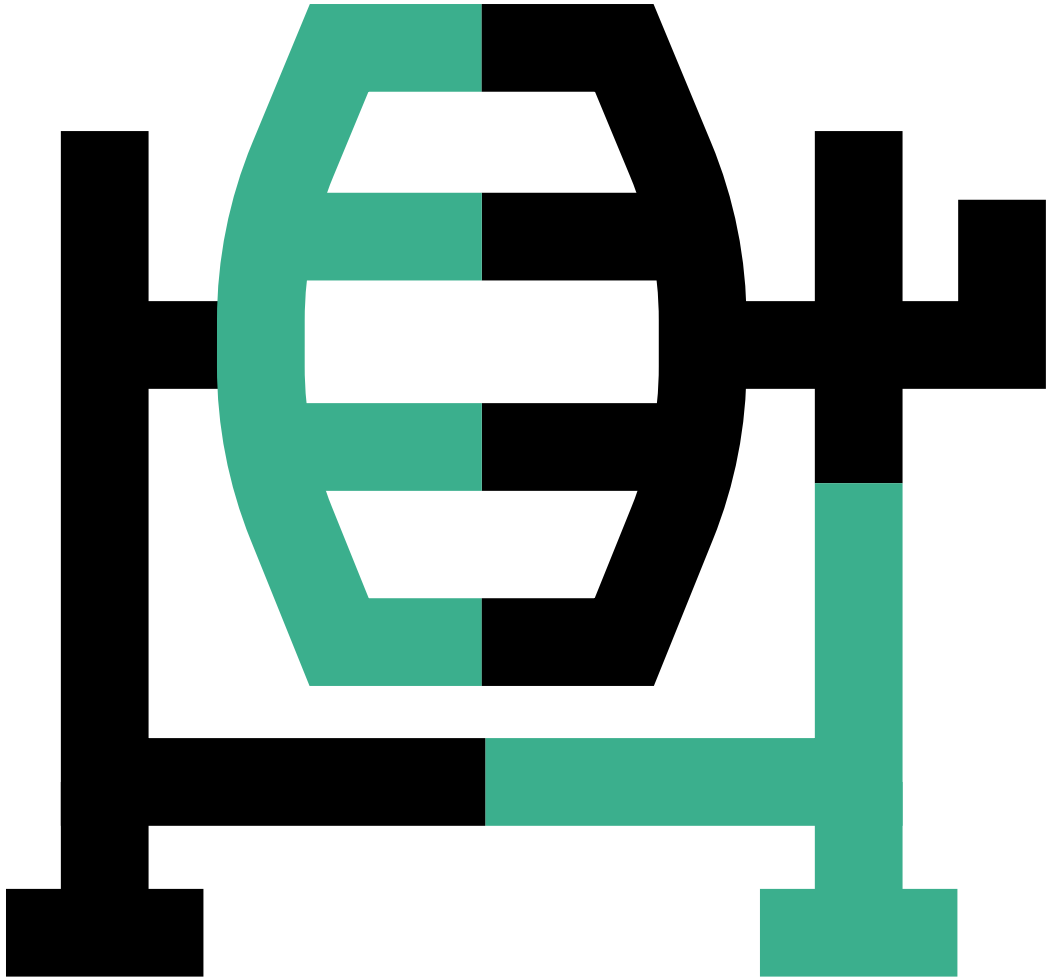
5.3 FA and GGBFS-based geopolymer binder

While geopolymer binder - in which FA and GGBFS as the source of amorphous silica and alumina are the main components, with the addition of alkaline activator for their activation - is being used in concrete for paving (Section 703), recent studies have shown that geopolymer binder is an effective replacement for Portland cement and lime in stabilisation projects. Field trials are required to be undertaken first though and requirements should be specified.

5.4 Bottom ash

Bottom ash (BA) is a by-product of coal combustion in power plants as well as gasification and incineration in energy from waste facilities. Studies show that BA can be used as a (full or partial) replacement for natural aggregate in formation and pavement layers. Transport for New South Wales is already allowing BA to be used in base and subbase layers, and the Queensland Department of Transport and Main Roads is currently investigating updating its specifications to incorporate BA through laboratory and field trials.

Due to similar chemical composition to that of FA, BA can be used as an SCM upon further processing such as crushing.



6. Disclaimer

This guide is not intended to make any legal representations and does not commit the Victorian State Government to any future course of action. Readers should not rely on these guidelines when making construction, business or investment decisions. The Victorian State Government and its departments and agencies accept no responsibility for any use of this guide, including for any loss or detriment resulting from reliance on or application of this guide.

7. Change Log

Version	Summary of updates
September 2022	Inclusion of Stabilisation, updates as per Section 407
August 2024	General updates in accordance with industry changes since last publication.

Appendix A – Reference Documents

A.1 Department of Transport Documents

Code of Practice RC 500.01 – Registration of Bituminous Mix Designs (2023)
Code of Practice RC 500.02 – Registration of Crushed Rock Mixes (2017)
Standard Section 176 – Environmental Management (Minor) (2016)
Standard Section 177 – Environmental Management (Major) (2016)
Standard Section 204 – Earthworks (2015)
Standard Section 205 - Rock Fill (2013)
Standard Section 404 - Stone Mastic Asphalt (2018)
Standard Section 405 – Regulation Gap Graded Asphalt (2014)
Standard Section 407 – Dense Graded Asphalt (2023)
Standard Section 408 – Sprayed Bituminous Surfacings (2022)
Standard Section 417 - Open Graded Asphalt (2018)
Standard Section 421 – High Binder Crumb Rubber Asphalt (2020)
Standard Section 422 – Light Traffic Crumb Rubber Asphalt (2019)
Standard Section 610 – Structural Concrete (2020)
Standard Section 701 – Underground Stormwater Drains (2023)
Standard Section 702 – Subsurface Drainage (2021)
Standard Section 703 – General Concrete Paving (2021)
Standard Section 705 – Drainage Pits and Covers (2023)
Standard Section 707 – Fencing (2018)
Standard Section 766 - Plastic Noise Walls (2023)
Standard Section 801 – Material Sources for the Production of Crushed Rock and Aggregates (2018)
Standard Section 812 – Crushed Rock for Pavement Base and Subbase (2016)
Standard Section 813 – Base and Subbase for Lower Trafficked Roads (2021)
Standard Section 815 – Cementitious Treated Crushed Rock for Pavement Subbase (2013)
Technical Note TN 107 – Use of Recycled Materials in Road Pavements (2023)

Appendix A – Reference Documents

A.2 Other Documents

AS 3582.1 – Supplementary cementitious materials for use with Portland and blended cement, Part 1: Fly ash
AS 3582.2 – Supplementary cementitious materials, Part 2: Slag - Ground granulated blast-furnace
AS 3582.3 – Supplementary cementitious materials for use with Portland and blended cement, Part 3: Amorphous silica
Austroads Guide to Pavement Technology Part 4E: Recycled Materials
Austroads Guide to Pavement Technology Part 4L: Stabilising Binders
Austroads Technical Specification ATS3110 Supply of Polymer Modified Binders
Extractive Resources Strategy (Department of Jobs, Precincts and Regions)
Recycling and Resource Recovery Infrastructure Evidence Base Report (Infrastructure Victoria)
Recycling Victoria Strategic Plan (Department of Energy, Environment and Climate Action)
Social Procurement Framework (Buying for Victoria)
Statewide Waste and Resource Recovery Infrastructure Plan (Sustainability Victoria)

Appendix B – Material Descriptions

Table B.1 — Material Descriptions

Material Category	Class	Description
Asphalt	L	A light duty Size 7 or 10 mm asphalt wearing course with low air voids and higher binder content for use in very lightly trafficked pavements.
	N	A light to medium duty Size 7, 10 or 14 mm asphalt wearing course or regulating course for use in light to moderately trafficked pavements.
	H	A heavy duty Size 7, 10 or 14 mm asphalt wearing course or regulating course typically used in mid-block applications on moderate to heavily trafficked pavements.
	SI	A Size 20 mm structural asphalt for intermediate course in heavy duty pavements or base course in medium duty pavements.
	SF	A fatigue resistant Size 20 mm structural asphalt base course for heavy duty asphalt pavements with a total asphalt thickness (excluding OGA) of at least 175 mm.
	SG	A multi-purpose heavy duty Size 20 mm structural intermediate course asphalt incorporating a multigrade binder for high resistance to deformation particularly at very heavily trafficked intersections.
	Regulation Gap Graded (RGG)	A Size 7 mm or smaller asphalt regulating course.
	High Binder Crumb Rubber Asphalt (HBCRA)	A specialised Size 10 mm or 14 mm asphalt wearing course or Size 20 mm structural base course with a high binder content and crumb rubber incorporated into the mix for use in heavily trafficked pavements.
	Light Trafficked Crumb Rubber Asphalt (LTCRA)	A Size 7, 10 or 14 mm asphalt wearing course with crumb rubber incorporated into the mix for use in light trafficked pavements.
	Open Graded Asphalt (OGA)	A Size 10 mm non-structural asphalt wearing course with high air voids and PMB for use in high speed environments such as freeways and highways.
	Stone Mastic Asphalt (SMA)	A Size 7 or 10 mm asphalt wearing course with PMB for use in heavily trafficked intersections and pavements.

Material Category	Class	Description
Crushed Rock	Class 1	A premium cohesive pavement base material for unbound pavements where a very high standard of surface preparation for a sprayed sealed or thin asphalt surfacing is required. It has a minimum plasticity index requirement and can have an additional requirement for maximum permeability when used for heavy duty unbound pavements.
	Class 2	A high-quality pavement base material for unbound flexible pavements in locations where a very high standard of surface preparation may not be required. Class 2 crushed rock does not have a minimum plasticity index or a maximum permeability requirement.
	Class 3	A high-quality upper subbase material for heavy duty unbound flexible pavements. It may have a minimum permeability requirement to provide positive drainage to the sub-surface drains and overlying unbound pavement layer.
	Class 4	A lower subbase material for heavy duty unbound and/or bound pavements or a subbase for most other types of pavements. It may have a maximum permeability requirement.
Lower Trafficked Base (LTB)		LTB is a base material for lower trafficked unbound flexible pavements lying directly beneath the bituminous surfacing; i.e. pavements carrying < 3500 Average Annual Daily Traffic (AADT) and < 10% heavy vehicles.
Lower Trafficked Subbase (LTS)		LTS is a subbase material for lower trafficked unbound flexible pavements; i.e. pavements carrying < 3500 AADT and < 10% heavy vehicles
Fill	Type A	A superior quality material complying with the requirements of Table 204.041 in Section 204, and is used principally as capping, selected material, structural material and/or verge material.
	Type B	A medium quality material that does not meet the requirements of Type A material, but meets the requirements outlined in Section 204 under clause 204.04c. Type B material is usually specified with a minimum CBR value.
	Type C	A lesser quality material that does not meet the requirements of Type A or Type B material, which may be used in Type C material zones of embankments as indicated on the drawings.
	Rock Fill	A material comprised of larger rock and rock fragments which may be used within Type B and Type C material zones at lower levels of high embankments in accordance with Section 205.
	Permeable Fill	Self-draining material, typically sand or aggregate.
Granular Filter Material		Granular material with the grading selected so that it will allow water to pass through it, while retaining solid matter.

Material Category	Class	Description
Sprayed Seal	Conventional	Where the bituminous binder is Class 170 bitumen or similar 'C' Class bitumen binders.
	High Stress Seal (HSS)	Where the bituminous binder is a lightly modified PMB or has at least ten parts of crumb rubber added to aid aggregate retention on heavily trafficked roads. HSS seals may be applied as a single/single application (HSS1) or a double/double application (HSS2).
	Extreme Stress Seal (XSS)	A double/double treatment where the bituminous binder is a medium to heavily modified binder, to accommodate extreme stresses imposed by heavy traffic volumes and high proportions of heavy vehicles or difficult service conditions.
	Strain Alleviating Membrane (SAM)	A sprayed seal with the binder containing a relatively large concentration of rubber or polymer modifier. It is used to absorb strains that occur in a road pavement and thereby reduce reflection cracking.
	Strain Alleviating Membrane Interlayer (SAMI)	Similar to a SAM but provided as an interlayer before placing an asphalt overlay.
General Concrete Paving	Geopolymer Concrete	Concrete which comprises geopolymer binder, aggregates, water and admixture. Where geopolymer binder is binder containing greater than 80% FA, GGBFS or amorphous silica complying with the requirements of AS 3582.1, AS 3582.2 and AS 3582.3 respectively, metakaolin and up to 20% alkaline components.
Stabilisation	Mechanical	Improving the engineering properties (e.g. PSD, plasticity, and CBR) of formation and pavement materials by adding a granular material or geosynthetics.
	By adding binder(s)	Improving the engineering properties of formation and pavement materials by adding a single cementitious and/or bituminous binder or blend of binders. For more details, refer to Austroads Guide to Pavement Technology Part 4L: Stabilising Binders (AGPT4L-09).
	Chemical	Improving the engineering properties of formation and pavement materials by adding chemicals (mainly proprietary products) such as synthetic polymers, ionic compounds and salts. For more details, refer to AGPT4L-09.

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For more information on the program and
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ecologiQ@roadprojects.vic.gov.au

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