SWA INNOVATION HUB

DECEMBER 2020

RECYCLE FIRST PLAN

Office of Major Transport Project Delivery (OMTID)

ACKNOWLEDGEMENTS

We would like to express our appreciation and acknowledge the excellent work that Main Roads Western Australia has done to date in the sustainability and recycled materials space, and in particular through the Western Australian Road Research and Innovation Program (WARRIP). In addition, special thanks goes to the iPrep students - Asha Ramachandran, Mona Arabshahi and Robert Weymouth for their valuable contribution to this body of work.

ABBREVIATIONS

BHRC	Bunbury Harvey Regional Council
BORR	Bunbury Outer Ring Road
COAG	Council of Australia Governments
C&D	Construction and Demolition
CRC	Crushed Recycled Concrete
DWER	Department of Water and Environmental Regulation
FOGO	Food Organics and Garden Organics
GHG	Greenhouse gas
IPWEA	Institute of Public Works Engineering Australasia
IS	Infrastructure Sustainability
ISCA	Infrastructure Sustainability Council of Australia
KRAs	Key Result Areas
LG	Local Government
MASP	Material Acceptance and Sampling Plan
MRF	Material Recovery Facility
MRWA	Main Roads Western Australia
NCCI	Noongar Chamber of Commerce and Industry
RAP	Reclaimed Asphalt Pavement
RCG	Recycled Crushed Glass
RDA	Regional Development Australia – South West
RtR	Roads to Reuse
SWA	Sustainability Waste Alliance
SWGA	South West Gateway Alliance
SWDC	South West Development Commission
SWRWG	South West Regional Waste Group
WALGA	Western Australian Local Government Association
WARRS	Waste Avoidance and Resource Recovery Strategy
3R	Regional Roads to Reuse

EXECUTIVE SUMMARY

TOWARDS100

This document presents a Recycle First approach to road construction and represents the first of its kind in Western Australia. It presents the case for a new approach to the way that major road projects are delivered. The application of this Recycle First Plan requires us to look at all parts of the engineering value chain very differently because of the starting assumption that everything in the project should be reused or recycled.

Using this "Towards100" approach leads to a paradigm shift in thinking. Instead of justifying increasing the amount of recycled content in a project (considering quality, price, and availability) we now have a starting point that 100% of materials will be reused or recycled and any departure from this stated objective will have to be justified. It flips everything on its head. It drives innovation and a move towards using more fit for purpose materials. It reveals new opportunities that have the potential of supporting the development of a strong waste recovery industry, regional economic development, and the creation of jobs.

BORR OPPORTUNITIES

This Recycle First Plan will be important for delivering the maximum amount of recycled content in the Bunbury Outer Ring Road Project (BORR). The Plan also attempts to generally encourage opportunities for increased recycled content in road construction in the South West beyond the BORR. For this reason, the recommendations break down into two main categories – those immediately present through the vehicle of the BORR and those with longer-term regional benefits following on from this project.

The Plan recommends that actions are taken through the vehicles of SWA and the SWGA to close gaps in current knowledge and practice that will improve the amount of recycled material used in the BORR project. They are:

- Use food and garden organics for landscaping/dust suppression,
- Use treated wastewater as an alternative to potable water for all water use such as compaction, dust suppression and landscaping,
- Maximise the use of crumb rubber in all wearing courses,
- Use crumb rubber in retaining walls or embankments,
- Use crushed recycled concrete in retaining wall blocks,
- Use recycled crushed glass as a drainage blanket,
- Use recycled crushed glass as a decorative additive to concrete elements,
- Explore potential use of Lithium by-product - Delithiated Beta Spodumene (DBS) as fill or as a stabilising agent,
- Increase the amount of co-mingled brick and tile material in pavement subbase in local government roads,
- Maximise the use of recycled asphalt pavement in local roads,
- Utilise recycled plastics in other ancillary infrastructure including handrails, decking, paths, and geogrids.

CHAPTER 1: BACKGROUND

BUNBURY OUTER RING ROAD (BORR)

The Bunbury Outer Ring Road (BORR) project is a significant part of the Western Australian Recovery Plan for the South West. The $852M BORR is proposed to consist of 27km of four-lane highway connecting Forrest & Bussell Highways and 21km of local government (LG) roads (Figure 1). This is one of the key components in the long-planned transport network for South West Western Australia.

BORR has been identified by Infrastructure Australia as a Priority Initiative – an opportunity of national significance. It is also being fast-tracked by the Western Australian State Government as a key part of the economic recovery post-COVID-pandemic, and construction work is scheduled to start in January 2021.

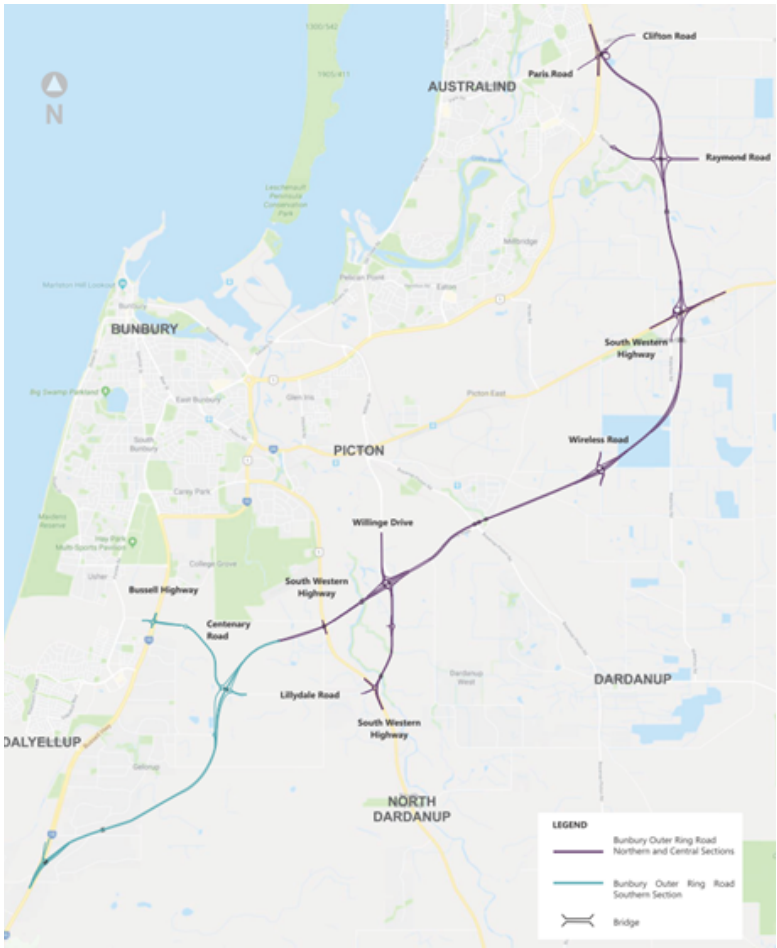
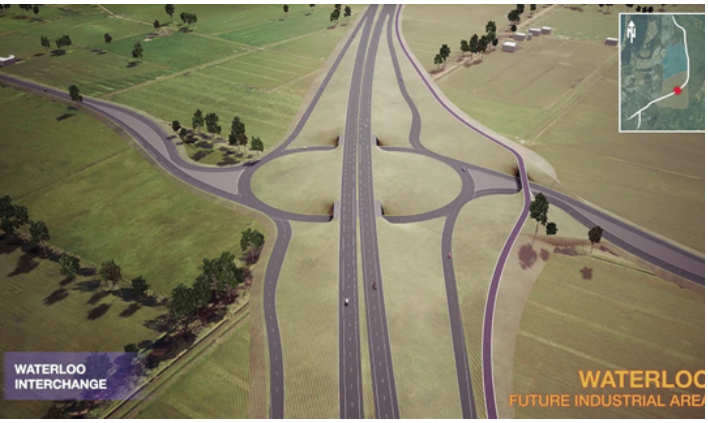


Figure 1 - Bunbury Outer Ring Road Map



PROJECT OBJECTIVES

The objective of the BORR is to produce the necessary road infrastructure to support the increased traffic between regional areas and reduce the impacts of vehicle movements on the local residential population, particularly the interaction of heavy vehicles and domestic traffic, thereby providing improved access to ports and industrial areas. Additionally, the project aims to enhance sustainability outcomes for the infrastructure associated with the Project, as measured by the Infrastructure Sustainability Council of Australia's (ISCA) infrastructure sustainability (IS) rating scheme.

BACKGROUND

SUSTAINABILITY WASTE ALLIANCE (SWA)

The Sustainability Waste Alliance (SWA) is a collaboration of key waste sector stakeholders important to the BORR project. SWA seeks to recover an additional 20% of waste within the wider South West, create 50 permanent jobs and drive regional and Aboriginal business growth in the South West. The SWA's Leadership Group consists of:

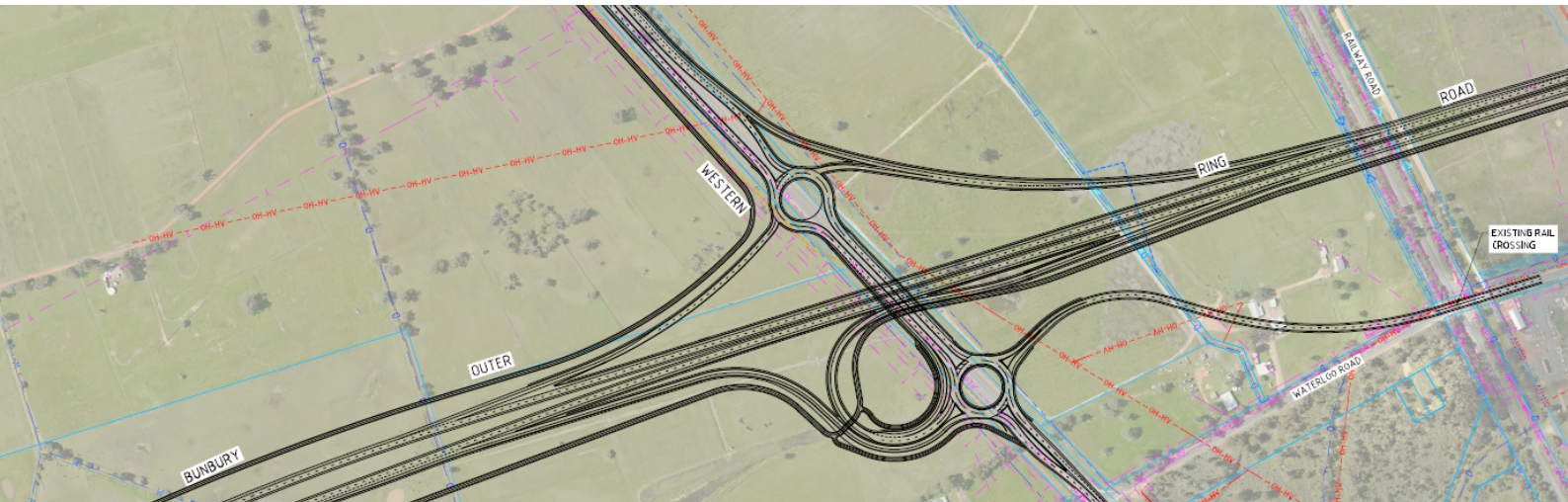
- The South West Development commission (SWDC);
- Regional Development Australia - South West (RDA);
- The Bunbury Harvey Regional Council (BHRC);
- The South West Regional Waste Group (SWRWG);
- The Noongar Chamber of Commerce and Industry (NCCI);
- Department of Water and Environmental Regulation (DWER); and
- Chaired by Main Roads Western Australia (MRWA).

SWA came together to harness the synergy produced by the BORR project to:

- accelerate progress toward state and national waste targets;
- develop new recycled content planning, design, specifications and practices of benefit to the BORR and future road projects; and
- leave a legacy of increased waste recovery and recycling in the South West.

As its initial primary objective, South West SWA delivered a Project Business Case / Feasibility Study which demonstrated the economic viability of delivering these three main activities and to achieve a low waste circular economy. This document outlined the capacity of the South West waste industry to deliver local recycled content at the scale and specifications required for the BORR project and, proposed co-investment and cost-sharing strategies intended to deliver cost-neutral or better-recycled content increases to the project and South West waste sector.

The Recycle First Plan takes the next step by introducing the "100% recycled content" approach and setting out additional detail about the program elements required to maximise local recycled content in the BORR project. These steps demand an integrated approach be taken by SWA, the South West Gateway Alliance (SWGA), key stakeholders and the SWA Innovation Hub to fast track the innovation, investment, resource optimisation and delivery in alignment with BORR time, cost, quality, value for money and local content objectives.



BACKGROUND

SWA INNOVATION HUB

The goal of the SWA Innovation Hub is to facilitate and enable best practice waste management and reuse/recycling practices in the South West transport sector and beyond. It was created to provide a vehicle for innovation, targeted research and development, local trialling of products on the ground in the South West, expert technical advice, local capability development, behavioural change and a focus on maximising the supply and demand for quality recycled materials in BORR and other related civil infrastructure.

The Innovation Hub facilitates the interventions required to deliver fit for purpose recycled content inputs staged to meet BORR project delivery schedules and specifications. The Innovation Hub will use the SWA Governance protocols and arrangements. These programs are delivered in collaboration with road and waste industry stakeholders committed to leaving a legacy of waste sector capacity and coordination improvements in the South West and replicable processes of value to the road industry. The priority focus areas align with the Waste Avoidance and Resource Recovery Strategy (WARRS) and include construction and demolition (C&D) waste, end of life tyres, food and garden organics (FOGO), recycled crushed glass (RCG), wastewater and recycled plastics.

The Innovation Hub will focus on building effective systems and processes that can be scaled up and applied much more widely to local government roads across the state and to parts of Main Roads regional road network. The benefits will therefore be much more substantial than the BORR project alone and this will deliver an increasing strong return on investment. It will allow the South West to become the leading region in the state in this space and a source of expertise, jobs, and trade well beyond its boundaries.

BACKGROUND

PRIORITIES OF GOVERNMENT

Premier McGowan has stated that "The same-old business-as-usual approach of government needs to evolve" and has established the 'Our Priorities: Sharing Prosperity' visionary program, which sets 12 key performance indicators to target important issues facing Western Australia. This includes creating new jobs, delivering regional prosperity, achieving a cleaner and more sustainable environment. One of the targets of the government's program is that by 2030 at least 75% of waste generated in Western Australia shall be reused or recycled.

Policy guiding the SWA spans all levels of of government and organisations, and includes Commonwealth, State and Local commitments such as:

COMMONWEALTH AND STATE

- The Australian National Waste Policy;
- The Council of Australia Governments (COAG) commitment to ceasing the export of waste materials from 2021;
- The Western Australian Waste Avoidance and Resource Recovery Strategy (WARRS) 2030 seeking material recovery increases to 70% by 2025 and 75% by 2030;
- Department of Transport's Recycle First policy through the BORR project;
- Closing the Gap.

MAIN ROADS

At the sub ministerial level, SWA also supports the following action statements from Main Roads Corporate Business Plan aimed at achieving improved sustainability outcomes:

- Increase the use of crushed recycled concrete (CRC) throughout the State to 200,000 tonnes on selected projects;
- Work with DWER and the Waste Authority to double the use of CRC on selected projects;
- Work up feasibility for greater use of lower energy pavement construction materials (e.g. extend natural gravels to high traffic loadings) and longer life pavements;
- Continue with the use of recycled C&D waste as sub-base under full-depth asphalt in Metro C&D projects (estimated at 100,000 tonnes per year); and
- Develop and implement alternative crumb rubber bituminous binders to double the current usage of MRWA and local governments (estimated over 1,200 tonnes per year).

BACKGROUND

LOCAL

The South West regional content and capacity development focus of the SWA has additional benefits that support:

- The recent WA Buy Local policy update that seeks to improve the return to regional areas from Government projects. These returns are strategic and sustainable and include the development of a waste recovery and recycling precinct to underpin the future growth of Kemerton, long term waste sector jobs and industry growth and Aboriginal employment and business development outcomes across these areas;
- The Noongar Recognition Act and Koort Kaart Waarnginy (Six Seasons Project Development Framework) through the participation of NCCI on the SWA Leadership Group;
- Value for Money policy by broadening the value delivery potential of the BORR project for cost-neutral or better initiatives; and
- Achieving an Infrastructure Sustainability Council of Australia Sustainability Rating of 60 or better.

SUSTAINABILITY DURING BORR

Road construction can have a significant environmental impact and whilst this is not limited to greenhouse gas contributions, it is often used as an easily measured proxy for impact. Preliminary analysis of the BORR project found that the largest materials contributions by whole-of-life greenhouse gas (GHG) contribution were from sand, precast concrete and bitumen (when factoring emission intensity and estimated volumes). Figure 2 shows the estimated breakdown and this guided the categorisation of the recommendations to increase recycled content in BORR as discussed in Chapter 2.

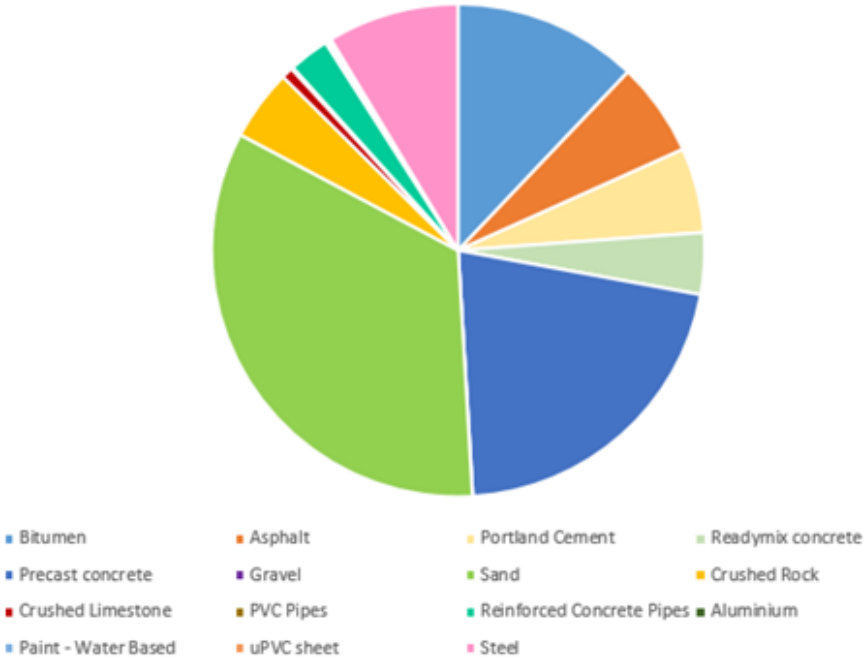


Figure 2 - GHG emissions for material production, manufacture, use and disposal

Research suggests that increasing the use of recycled materials could substantially reduce carbon footprint. Further investigation should be undertaken to assess the carbon footprint improvement on the use of recycled content in comparison to virgin materials.

BACKGROUND

SUSTAINABILITY ASSESSMENT

Measuring sustainability across these material inputs is critical to ensuring outcomes meet performance targets. This is addressed in two ways in this Plan:

1. At the scale of the BORR project; and
2. At the scale of the South West region.

The primary method of assessing the sustainability outcomes of the BORR project is through the ISCA IS Rating Scheme which has already informed the planning stage of the BORR project.

The ISCA V2.0 provides an accreditation system for infrastructure projects through a four-step rating process as shown in Figure 3 below.

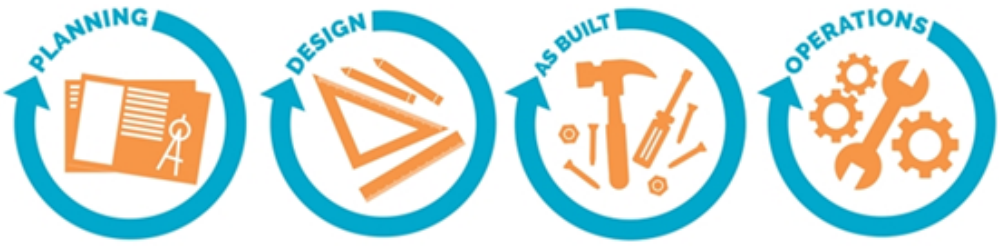


Figure 3 - ISCA Rating Phases

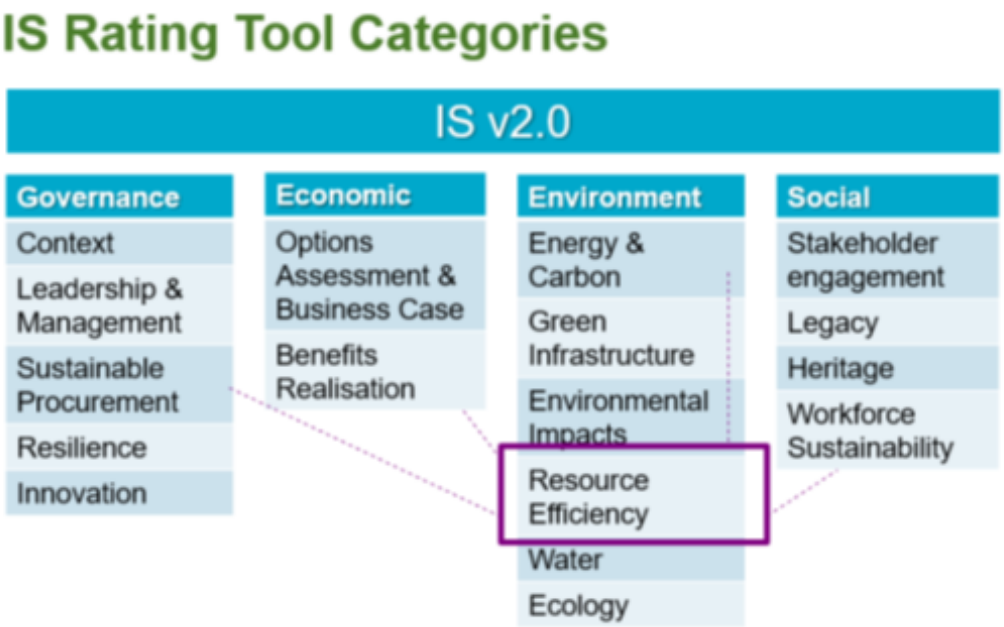


Figure 4 - IS Rating Tool Categories

BACKGROUND

Points are assigned to various activities within four categories namely Environmental, Social, Economic and Governance to a total of 110 points. The primary value that the SWA Innovation Hub can contribute to the BORR sustainability metric under each category are shown below and in Figure 4.:

- Environmental - Resource Efficiency
- Economic - Benefits Realisation
- Social - Workforce Sustainability
- Governance - Sustainable Procurement
- Legacy projects, and
- Innovation.

The SWGA, the Alliance which will deliver the BORR project, is tasked with achieving an IS Rating score of 60 out of 110 for the BORR project through achieving high performance in each of the Credits that sit below each of the categories identified above. This high standard of sustainability performance will be required for both the Design and As-Built Rating. The sustainability initiatives presented in this Recycle First Plan were developed after these targets were set, suggesting there is an opportunity to substantially exceed the 60 points ISCA target through achieving the goals established in the Recycle First Plan. These goals incorporate a commitment that recycled content solutions proposed to SWGA must innovate to deliver cost-neutral or better performance.

SUSTAINABILITY BEYOND BORR - "TOWARDS100" PHILOSOPHY

The Recycled First Plan targets the highest practical level of the Waste Hierarchy – Reuse and Recycling (Figure 5).

Modelled on best Australian practices and successful programs, the Recycle First Plan sets an aspirational starting point of 100% reused or recycled materials in road construction – referred to as 'Towards100'. This philosophy flips the paradigm to require justification for replacing recycled materials, as opposed to the current approach which requires justifying the replacement of virgin materials. The purpose is to accelerate the incorporation of recycled content into the BORR through driving innovation that delivers competitive recycled material replacements for virgin material in terms of quality, price, and availability.

BACKGROUND

The Recycled First Plan builds on the successes of analogous programs in other states in Australia – particularly Victoria. The Victorian Recycled First Policy was created in response to increasing waste volumes and a change of policy by China requiring additional processing of recycled waste imports (as opposed to intermingled, bundled recyclables), and an ambitious infrastructure program (referred to as "The Big Build").

The policy was built on several years of pilot projects and major project experience using recycled materials in road and rail construction. The policy sets a standard for the use of recycled material in road construction as being the maximum allowed by the relevant specification. For example, if the specification relevant to CRC in sub-base for a specific project is 40% then it is mandatory that the project procures this minimum amount and it is preferable that it procures more.

The Victorian Recycle First Policy and support measures were delivered methodically and rapidly, with ongoing feedback and fine-tuning mechanisms built-in. The Recycle First Plan for the BORR project combines these approaches into a pilot project structure, with technical and commercial innovation support and feedback loops embedded through the alliance structure of the SWGA and SWA to ensure cost neutral, quality and timeliness requirements are met.

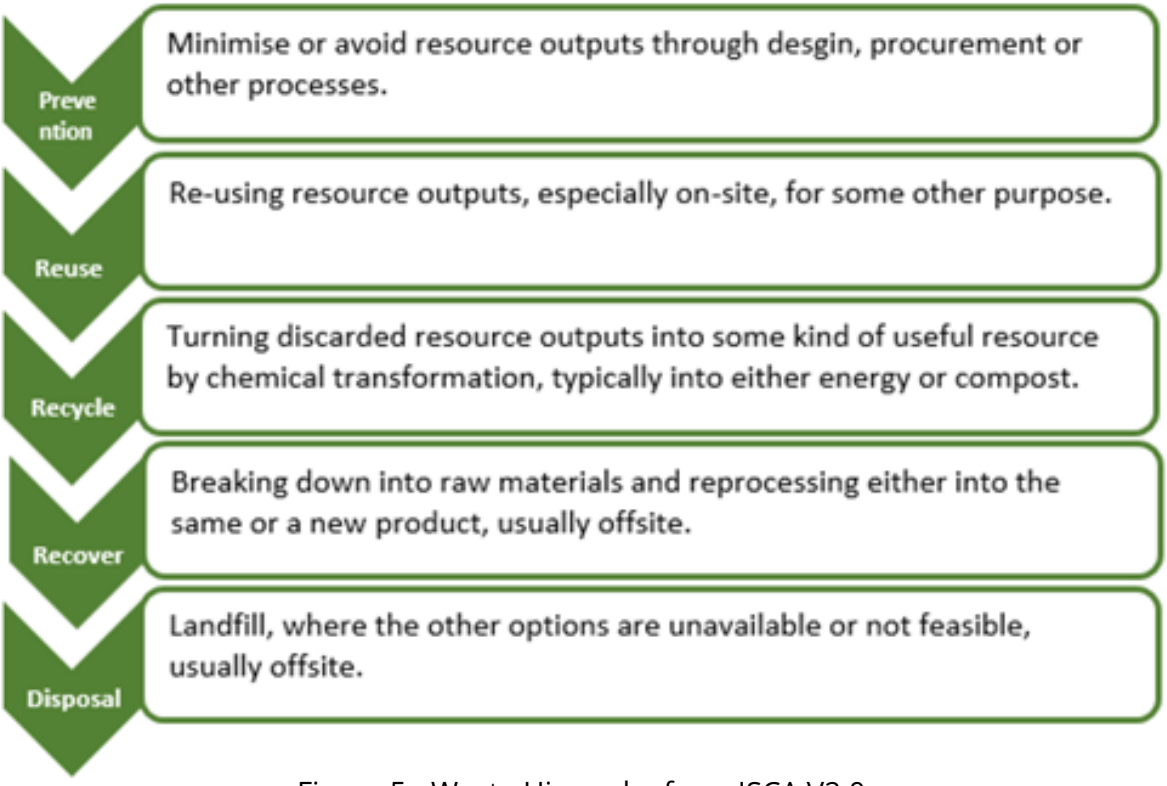


Figure 5 - Waste Hierarchy from ISCA V2.0

BACKGROUND

PURPOSE AND STRUCTURE

By inverting the current paradigm, the road design and construction process reveals new reuse and recycling opportunities, and they drive innovation towards more fit for purpose materials and processes. This approach allows a re-examination of what constitutes 'fit for purpose' materials and processes, and supports a circular economy.

The Recycle First Plan embraces the existing State Government performance standards relating to durability, safety, environmental protection. The focus is on developing new recycled product specifications that will meet these standards through procurement mechanisms. The SWA Innovation Hub is currently partly resourced to develop these specifications and to demonstrate their effectiveness.

This Plan showcases opportunities in the South West to move Towards100, addresses relevant procurement processes and product specifications, and makes recommendations for an industry toolkit to improve material quality and availability.

The opportunities are sorted by:

- those that can be actioned immediately because they meet the rapid rollout requirements of the BORR project, and are of low project risk; and
- those that may become apparent during the later design and delivery of the project, and may become useful beyond the BORR project.

The priorities used to judge the value of an opportunity are described and then each waste stream opportunity is mapped against these priorities. Those that best meet the priorities are summarised in Chapter 2.

CHAPTER 2: OPPORTUNITIES FOR RECYCLING IN ROAD CONSTRUCTION IN THE SOUTH WEST

Significant quantities of materials are required to construct the BORR project.

INDICATIVE MATERIAL QUANTITIES FOR BORR

Table 1 below shows an indicative estimate of the quantities of materials required to complete the BORR project. Virgin raw materials are available within the Bunbury area (20 – 100km) and most processed materials such as steel or pipes will be sourced from Perth. These values inform the prioritisation of recycled material opportunities that will be discussed in the following sections of the report.

Material	Quantity	unit
Fill	4.5	*million tonnes*
Pavement - Basecourse	790000	*tonnes*
Pavement - Subbase	670000	*tonnes*
Wearing Course - Prime and Seal	2270000	m^2
Wearing Course - Asphalt and Microsurfacing	540000	m^2
Compost/Landscaping	50000	*tonnes*
Water	3	*megalitres/day*
Concrete	44000	m^3

Table 1 - Indicative material quantities required for BORR

The quantities of recycled materials that can be supplied in the South West to satisfy BORR requirements need further analysis and will be confirmed in due course.

PRIORITISING RECYCLING OPPORTUNITIES

The following criteria were applied when prioritising the opportunities to use recycled material in the BORR.

OPPORTUNITIES FOR RECYCLING IN ROAD CONSTRUCTION IN THE SOUTH WEST

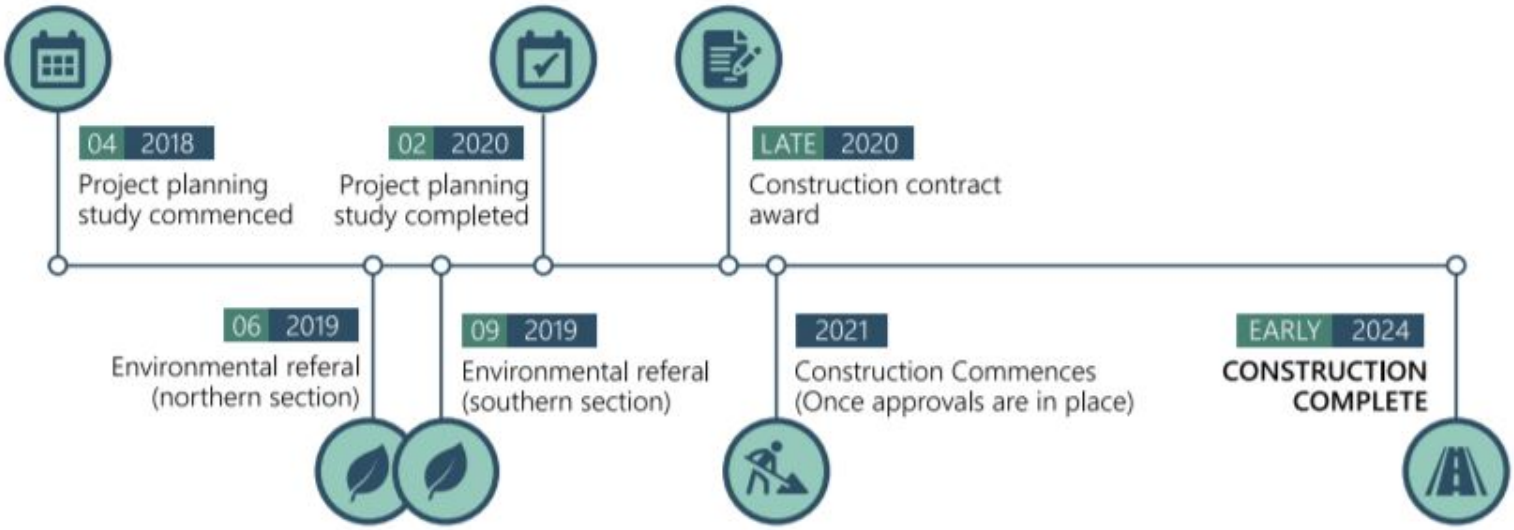
PRIORITISATION FACTOR – TIMING

The signing of the agreement for the SWGA has set a construction start date of January 2021. This creates significant time pressure to develop some recycled materials almost immediately. The following schedule will determine timeliness depending on the material. For example:

- Fill and earthwork opportunities (from 2021) - fill substitution. earthworks, hardstand areas and wastewater for dust suppression will need to be delivered;
- Pavement opportunities (2021-2022) - glass capillary layers, co-mingled C&D sub-base layers, CRC, plastic geogrids, and other recycled pavement products will be required during this period;
- Wearing course opportunities (from 2022) - crumb rubber spray seals and asphalt will need to be undertaken in the latter half of the construction phase; and
- Finishing opportunities (from 2023) - FOGO mulch and compost for landscaping, CRC in retaining walls, recycled plastic ancillary uses such as handrails, etc. will be required towards the end of the project. Treated wastewater for watering landscaping.

Opportunities that do not meet the required quantities within these timeframes will not be pursued.

Key milestones and critical path items for delivery of BORR include:



OPPORTUNITIES FOR RECYCLING IN ROAD CONSTRUCTION IN THE SOUTH WEST

PRIORITISATION FACTOR – FIT FOR PURPOSE

All opportunities need to be fit for purpose where the material or product must be shown to meet Main Roads' performance standards. This includes performance over the entire service life. Opportunities that require extensive testing/research or have not been proven by actual implementation in previous road projects in Western Australia are less likely to be fit for purpose for BORR.

PRIORITISATION FACTOR – SUSTAINABILITY

It is understood that Key Result Areas (KRA's) identified in the Performance Management Plan by the SWGA will include sustainability and will be quantified through the performance using the ISCA framework.

In the absence of a full value for money process, opportunities are prioritised by being of equal or less environmental, social and economic cost than business as usual (non-recycled) alternatives. Whole-of-life impact has been used where this is known and can be estimated accurately.

PRIORITISATION FACTOR – VALUE FOR MONEY

The value-for money process is yet to be determined and this will include the balancing of financial cost with the other KRAs of environmental protection, sustainability, indigenous engagement and local employment creation. In its absence opportunities are prioritised by being of equal or lesser cost than business as usual (non-recycled) alternatives. Whole-of-life cost will be used where it can be estimated accurately.

OPPORTUNITIES FOR RECYCLING IN ROAD CONSTRUCTION IN THE SOUTH WEST

RECYCLING OPPORTUNITIES IN THE SOUTH WEST AND DURING BORR

Multiple opportunities to utilise recycled content in the BORR and South West were identified and prioritised through the SWA stakeholder engagement, Value Management, market review processes and Value Engineering Workshop. These opportunities were grouped according to six focus materials. Figure 6 shows examples of reused or recycled products across these focus materials being recycled and reused across a typical cross-section of the BORR project. Each of these material streams is described in detail following the figure and all the opportunities are summarised at the end of this Chapter.

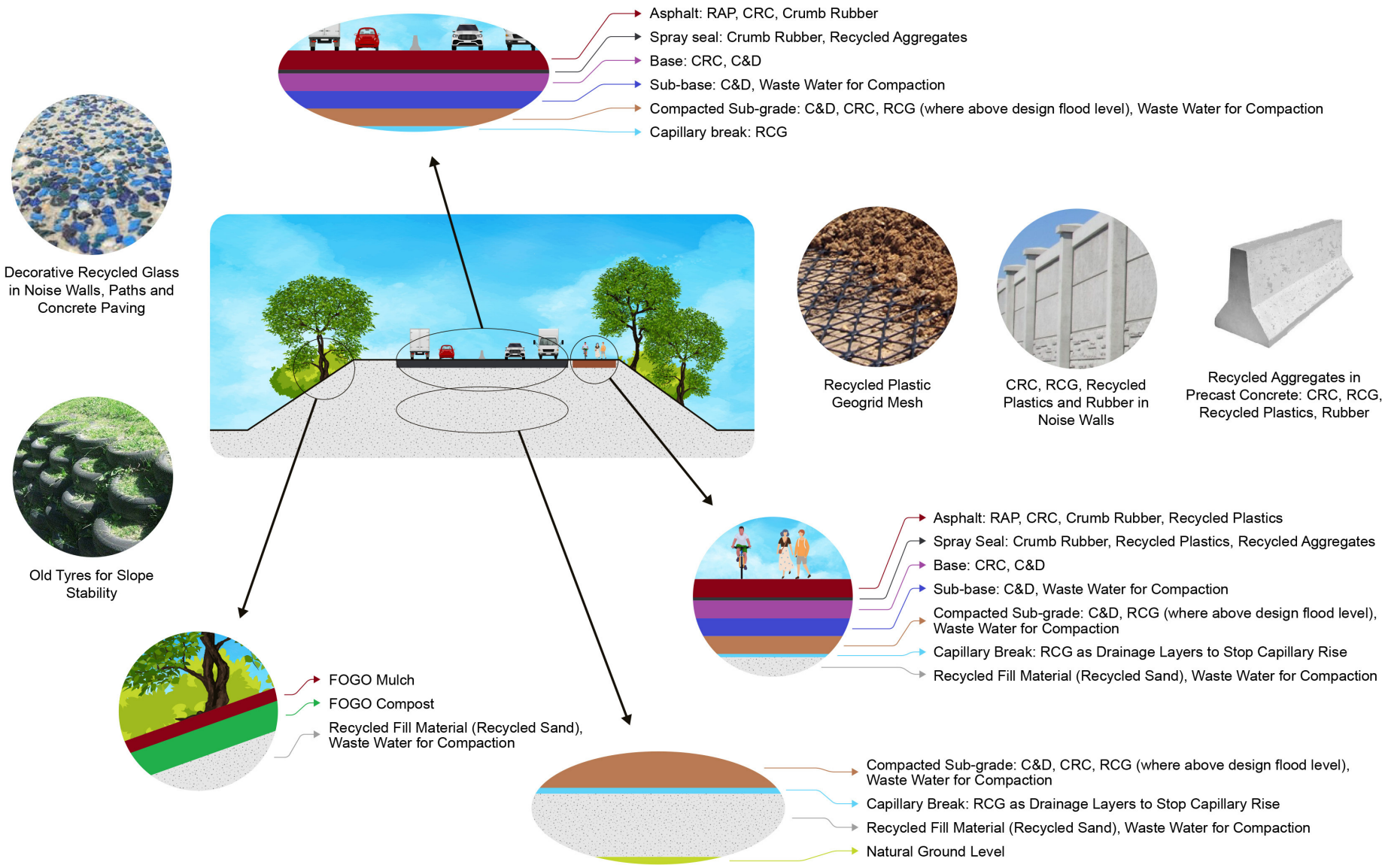


Figure 6 - Opportunities for Recycling in the BORR

OPPORTUNITIES FOR RECYCLING IN ROAD CONSTRUCTION IN THE SOUTH WEST

FOGO OPPORTUNITIES

Using compost products from FOGO processing has now become an established practice to strengthen planting and revegetation. There are significant environmental benefits available through diverting FOGO from landfill and landscape rehabilitation benefits such as reduced irrigation and fertilisation costs. South West FOGO materials have been used on Main Roads projects in the past and are likely to be the most convenient and cost-effective source for the large volumes of topsoil remediation and mulch required by the BORR project. Demand for recycled green waste in BORR is yet to be confirmed.

It is expected that demand for FOGO will begin in 2022–2023 and continue for several years following practical completion of the BORR project. Current local production of FOGO compost (12ktpa) is largely accounted for by regular local customers. Plans and a licence are in place for an expanded facility capable of meeting the additional demand required by the BORR project. A marketing strategy and spreading business targeting agricultural uses is proposed to ensure reliable demand. The proposed expansion will create additional long-term local employment opportunities including a proposal to deliver Noongar jobs across all categories and to develop the compost spreading business as a Noongar operated and controlled business.

The SWA Project Business Case assessed a proposed FOGO expansion to deliver 20 ktpa as feasible. Compost and mulch produced through the current facility and the proposed expansion meet / will meet the required AS4454 specifications and organic certification.

Opportunities for BORR:

- Use of FOGO compost as soil replacement in roadside landscaping in embankment areas and also where excavation has removed the topsoil.
- Use of FOGO in the form of compost blankets as an erosion control as it improves soil structure and biology and works as a stormwater filter.
- Use of compost from FOGO waste as organic fertiliser to establish BORR planting.
- Use of FOGO mulch to reduce water evaporation from ground surface, suppress dust, and enrich soil for plant growth following establishment.

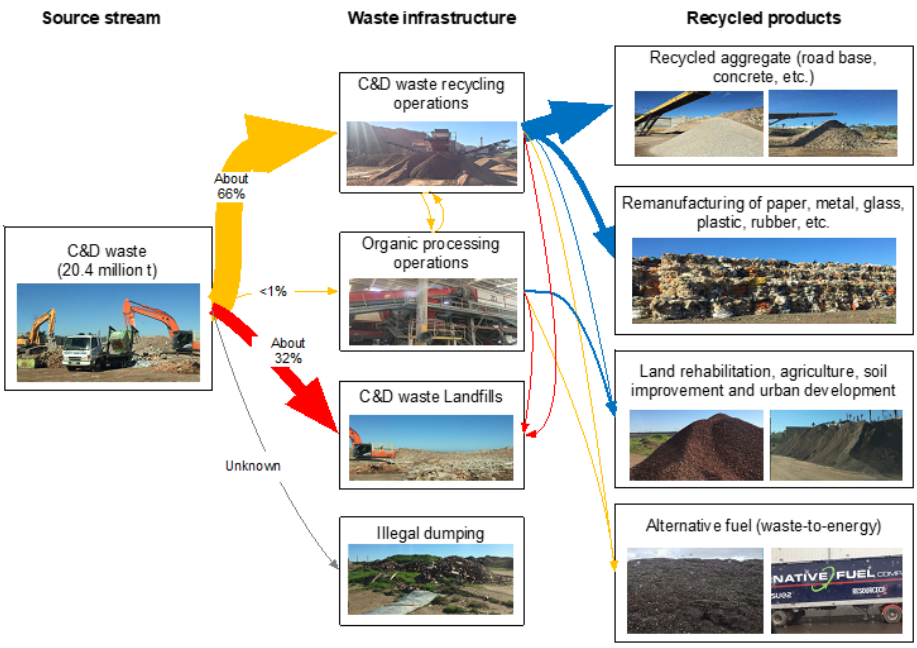
OPPORTUNITIES FOR RECYCLING IN ROAD CONSTRUCTION IN THE SOUTH WEST

C&D OPPORTUNITIES

The use of C&D material, asphalt millings and other recycled products have become significantly more attractive in the Perth metropolitan area since the introduction and subsequent increase in landfill levy from $8 to $40 per tonne. The supply of source-separated inert C&D materials suitable for recycling in the South West is limited due to the region's lack of a landfill levy, low landfill fees for clean fill and inert materials, and the widespread use of these materials as daily landfill cover. The future introduction of a landfill levy in the South West has the potential of increasing the supply of these recycled materials.

Opportunities for BORR:

- Maximise inert C&D waste usage in base and sub-base of LG roads as a more cost-effective structural fill in subbase under sealed pavements.
- Conduct investigations into the potential of co-mingled C&D waste to degrade over the long-term into clay and what affect this would have on the performance risk profile.
- Use of co-mingled C&D waste under sealed hardstand areas, and for structural fill under pavements.
- Use of CRC for use in non-structural precast concrete products or limestone blocks for retaining walls, median barriers, footpaths and extruded kerbs.
- Explore the different properties required for these non-structural products as well as backing blocks (cement content or other), precast concrete products and face blocks to increase the range of uses for CRC. Contingent on these properties, prepare a supporting draft specification in consultation with Main Roads.
- Provide technical assistance to local manufacturers based on the above specification to facilitate the use of this waste product.
- Maximise the use of recycled asphalt pavement (RAP) in asphalt wearing courses and bike paths.
- C&D waste generated by the BORR project to be sorted, collected, recycled and either reused in the project or made available to other road projects.
- Develop new specification and procurement protocols to encourage the use of recycled C&D waste in LG roads that fully conforms with the Road to Reuse (RtR) requirements and supports an ongoing market for these materials.



OPPORTUNITIES FOR RECYCLING IN ROAD CONSTRUCTION IN THE SOUTH WEST

- Establish an alliance with large C&D industry contractors to develop supply and crushing processes that result in a product that meets standard requirements for fill and CRC at a pre-determined price.
- Explore the opportunity for knowledge transfer from successful Perth contractors to local recyclers to enhance regional capacity and ensure supply chain integrity leading to consistent material.

WASTEWATER OPPORTUNITIES

Due to the adverse impacts posed by climate change, Bunbury, like most Australian regional communities, will need to effectively manage the recycling of wastewater that is currently discharged into the ocean. In Bunbury, only 14% of treated domestic wastewater is currently being recycled. There is an opportunity to increase the proportion of wastewater being reused or recycled. Of concern is the increasing difficulty of accessing groundwater from the shallow Superficial Aquifer close to the coast due to seawater intrusion.

The Greater Bunbury water treatment industry is complex and requires significant investigation, and investment before it can address this shortage and meet Water Corporations' 2030 target of reusing 30% wastewater. The BORR project is expected to consume 3 megalitres of water per day mostly for dust suppression purposes during construction. This would harm sustainability outcomes if potable or groundwater were to be used. Therefore, opportunities exist to meet BORR and local demand through existing and the proposed expansion of industry and government wastewater treatment facilities.

Early investigations suggest that the opportunity to harness the BORR project to bring forward these investments is realistic. SWA has since established a target of recovering an additional 30% of wastewater for non-potable uses. The required volume of treated wastewater is available from various sources in the Bunbury region. The WA State government has recently announced a $11.9M contribution for the delivery of wastewater facilities to support infrastructure projects in the South West region.

Opportunities for BORR

- The main application of wastewater is for dust suppression and road compaction (in applications other than for base course).
- The use of wastewater for landscaping requirements during the project.
- Potential for a legacy project of significant social value for an integrated wastewater distribution system for Bunbury in the future.

OPPORTUNITIES FOR RECYCLING IN ROAD CONSTRUCTION IN THE SOUTH WEST

- Treated wastewater will minimise the use of potable water for construction as a key ISCA sustainability requirement in BORR.
- Further development of an integrated wastewater management plan aligned with water and waste management for the entire catchment / region is recommended. This could drive collaboration between producers / industries and potential users of treated wastewater.

CRUMB RUBBER OPPORTUNITIES

The use of recycled material such as end-of-life tyres in road construction is a common practice internationally. For many years, Western Australia has adopted the use of crumb rubber in road pavement construction for its improved performance. Currently, there is a window of opportunity for Western Australia to maximise the use of crumb rubber through the BORR project. It is estimated that the BORR project could utilise up to 1,000 tonnes of crumb rubber in wearing courses.

At present, the South West region generates approximately 4,000 tonnes per annum of truck and mining tyres and conveyor belts. Hence, a goal is set to send all the end of life tyre and conveyor belt waste generated in the South West to a central location for shredding or packaging before it is trucked to Perth for crumbing and used for crumb rubber binder modification. The possibility of setting up a crumbing facility in Bunbury is under consideration by the SWRWG. To achieve 100% of LG roads with crumb rubber, scheduling spray sealing work predominantly in the warmer months would be a requirement. Establishment of local crumb rubber processing facilities and specifications maximising the use of crumb rubber will also help in moving towards the 100% target.

Opportunities for BORR:

- To maximise the use of recycled crumb rubber in spray seal and asphalt wearing courses along the main alignment. Crumb rubber wearing courses are marginally more expensive but give a better life cycle cost. The BORR project will align with Main Roads Specification of 15-18% of crumb rubber as a replacement for bitumen by volume.
- It is proposed that BORR will utilise crumb rubber under all full-depth asphalt pavements constructed during the project. Main Roads has plans to increase crumb rubber inputs to asphalt, thereby driving up demand.
- Other suggested applications involve the use of crumb rubber in noise walls, retaining walls and for bridge deck waterproofing.

OPPORTUNITIES FOR RECYCLING IN ROAD CONSTRUCTION IN THE SOUTH WEST

GLASS OPPORTUNITIES

Recycled crushed glass (RCG) as permeable and free-draining material with low optimum moisture content can be used as a substitute for virgin aggregates for fill applications. However, RCG supply is unknown in the South West due to limited crushing facilities.

Opportunities for BORR:

- Maximise the use of RCG as a drainage blanket contingent on further investigation– there is a potential use of crushed glass as capillary rise protection layer at locations where lowering embankment height results in significant savings such as under interchange bridges in areas where there is a shallow water table.
- Develop an optimised grading envelope for RCG as a drainage blanket for testing at Main Roads labs.
- Use testing and the Western Australian Road Research and Innovation Program (WARRIP) research to prepare a draft specification for use in BORR at selected locations where lowering embankment height gives significant flow-on savings (e.g. on low fills under interchange bridges and on LG roads).
- Work with potential local industry suppliers to produce a product that meets requirements and specifications.·
- Use as partial sand replacement in concrete or asphalt pavements.
- Use as a potential partial replacement for crushed rock basecourse in LG roads
- Investigate the technical requirements for the use of RCG as a decorative feature in concrete noise walls, paths and concrete infill/ paving.
- Determine the required improvements to the local supply chain to ensure the correct material characteristics and properties for the decorative use of RCG.
- Evaluate triple bottom line desirability of decorative use based on high embedded energy, water consumption and cost.
- Use as partial fill material for embankments.
- Use in non-structural precast concrete products.

OPPORTUNITIES FOR RECYCLING IN ROAD CONSTRUCTION IN THE SOUTH WEST

PLASTIC OPPORTUNITIES

Plastic is a significant contributor to Australia's waste generation. With so much plastic going to landfill, especially after the enforcement of the China National Sword Policy, there is growing interest in exploring the viability of using recycled plastic in roads and related infrastructure.

So far, the use of recycled plastics in roads in Australia has largely been confined to asphalt applications. The proprietary products containing recycled plastics are currently manufactured in the Eastern States. The BORR project provides an avenue to establish additional facilities in the South West to produce these proprietary materials in Western Australia utilising local plastic waste.

Opportunities for BORR:

- Use as a binder modifier to enhance pavement performance.
- Use of recycled plastics in bike paths and ancillaries such as handrails, guardrail, posts, bollards, fences, etc.
- Use of geogrid mesh manufactured from recycled plastics in soil reinforcement.
- Establishment of a facility in South West to utilise local plastic waste to manufacture the products.

OPPORTUNITIES FOR RECYCLING IN ROAD CONSTRUCTION

SUMMARY

The following is a summary of the opportunities across the waste streams discussed in this section.

Waste Material	Application	Recommendations
FOGO	Landscaping/ Dust suppression	• Use of FOGO compost as soil replacement in roadside landscaping in embankment areas and also where excavation has removed the topsoil. • Use of FOGO in the form of compost blankets as an erosion control as it improves soil structure and biology and works as a stormwater filter. • Use of compost from FOGO waste as organic fertiliser to establish BORR planting. • Use of FOGO mulch to reduce water evaporation from the ground surface, suppress dust and enrich the soil for plant growth following establishment.
Wastewater	Compaction/ Dust suppression/ landscaping	• The main application of treated wastewater is for dust suppression and road compaction (in applications other than for base course). • The use of treated wastewater for landscaping requirements during the project. • Potential for a legacy project for an integrated wastewater distribution system for Bunbury in future. • Wastewater could minimise the use of potable water for construction as a key ISCA sustainability requirement in BORR. • Further development on an integrated wastewater management plan aligned with water and waste management for the entire catchment/region is recommended. This could drive collaboration between producers/industries and potential users of treated wastewater.
Crumb Rubber	All wearing courses	• Maximise the use of crumb rubber in spray sealing to 100% for local government roads. • To maximise the use of recycled crumb rubber in spray seal and asphalt wearing courses along the main alignment. Spray seal is marginally more expensive but gives a longer life cycle cost. The BORR project aims to use a 15-18% of crumb rubber by mass of total modified binder. • It is proposed that BORR will utilise crumb rubber under all full-depth asphalt pavements constructed during the project. MRWA has plans to increase crumb rubber inputs to asphalt, thereby driving up demand. • Other suggested applications involve the use of crumb rubber in noise walls, retaining walls and bridge deck water • Develop new specification supplement and procurement protocols for local roads maximising the amount of recycled rubber in roadworks without compromising on the performance. • Determine the cost of processing and crumbing rubber in the SW compared to the transportation of crumb rubber from Perth.
Glass	Capillary blanket Decorative concrete inclusions Partial sand replacement	• Maximise the use of RCG as a drainage blanket contingent on further investigation– there is a potential use of crushed glass as capillary rise protection layer at locations where lowering embankment height results in significant savings such as under interchange bridges in areas of shallow water table. • Develop an optimised grading envelope for RCG as a drainage blanket for testing at Main Roads labs. • Use testing and WARRIP research to prepare a draft specification for use in BORR at select locations where lowering embankment height gives significant flow-on savings (e.g. on low fills under interchange bridges and on LG roads). • Work with potential local industry suppliers to produce a product that meets requirements and specifications. • Use as partial sand replacement in concrete or asphalt pavements.

OPPORTUNITIES FOR RECYCLING IN ROAD CONSTRUCTION

Waste Material	Application	Recommendations
		• Investigate the technical requirements for the use of crushed glass as a decorative feature in concrete noise walls, paths and concrete infill/ paving. • Determine the required improvements to the local supply chain to ensure the correct material characteristics and properties for the decorative use of crushed glass. • Evaluate triple bottom line desirability of decorative use based on high embedded energy, water consumption and cost. • Use as partial fill material for embankments. • Use in non-structural precast concrete products.
Plastic	Binder modifier Various products	• Use as a binder modifier to enhance pavement performance. • Use of recycled plastics in bike paths and ancillaries such as handrails, guardrail, posts, bollards, fences, etc. • Use of geogrid mesh manufactured from recycled plastics in soil reinforcement. • Establishment of a facility in South West to utilise local plastic waste to manufacture the products.
C&D	Crushed Recycled Concrete Co-mingled C&D and crusher dust in LG roads Co-mingled C&D material in the subbase	• Maximise C&D usage in base and subbase of local government roads as a more cost-effective structural fill in subbase under sealed pavements. • Conduct investigations in the potential of co-mingled C&D waste to degrade over the long-term into clay and what affect this would have on the performance risk profile. • Use of co-mingled C&D waste under sealed hardstand areas, and for structural fill under pavements. • Use of CRC for use instead of non-structural precast concrete products or limestone blocks for retaining walls, median barriers, footpaths and extruded kerbs. • Explore the different properties required for these non-structural products as well as backing blocks (cement content or other), precast concrete products and face blocks to increase the range of uses for CRC. Contingent on these properties and prepare a supporting draft specification in consultation with Main Roads. • Based on this specification, provide technical assistance to local manufacturers to facilitate the use of this waste product. • Maximise the use of RAP in asphalt wearing courses and bike paths. • Investigate the availability and use of crusher dust as fill in sub-bases, improved sub-grade, or haul roads. • C&D waste generated by the BORR project to be sorted, collected, recycled and either reused in the project or made available to other road projects. • Develop new specification and procurement protocols to encourage the use of recycled C&D waste in local government roads that is aligned with the DWER and RtR requirements and supports an ongoing market for these materials. • Establish an alliance with large C&D industry contractors to develop supply and crushing processes that result in a product that meets standard requirements for fill and CRC at a predetermined price. • Explore the opportunity for knowledge transfer from successful Perth contractors to local recyclers to enhance regional capacity and ensure supply chain integrity leading to consistent material.

CHAPTER 3: C&D WASTE FOR ROAD CONSTRUCTION

Construction and demolition (C&D) waste makes up half of the WA waste stream. The WARRS has a recovery target of 80% by 2030 and aims to move Western Australia towards a sustainable, low waste circular economy in which human health and the environment are protected from the impacts of waste. In line with the philosophy of Towards100, this section of the Plan focuses on addressing the barriers to the increased use of C&D – the specifications regarding its use and a toolkit to assist the supporting industry.

BACKGROUND

Over 1.5 million tonnes of C&D materials are processed annually in WA and stockpiles exist of 1 million cubic meters of varying quality. Promisingly, the C&D waste recovery rate has increased dramatically since 2014-15 and has now achieved the Waste Strategy 2030's C&D target of 75% for 2020 (Figure 7). Studies reveal that the actual quantity of waste recycled from the C&D sector has decreased by 130,400 tonnes since 2014-15. However, the quantity of material landfilled has decreased by 79% to 372,300 tonnes over the same period. This suggests that the increased rate of C&D recycling reflects a reduction in reported waste disposal rather than an increase in recycling activity for the sector. It will be necessary to reverse this trend to ensure C&D recovery targets are reached and C&D becomes a high volume input into road construction.

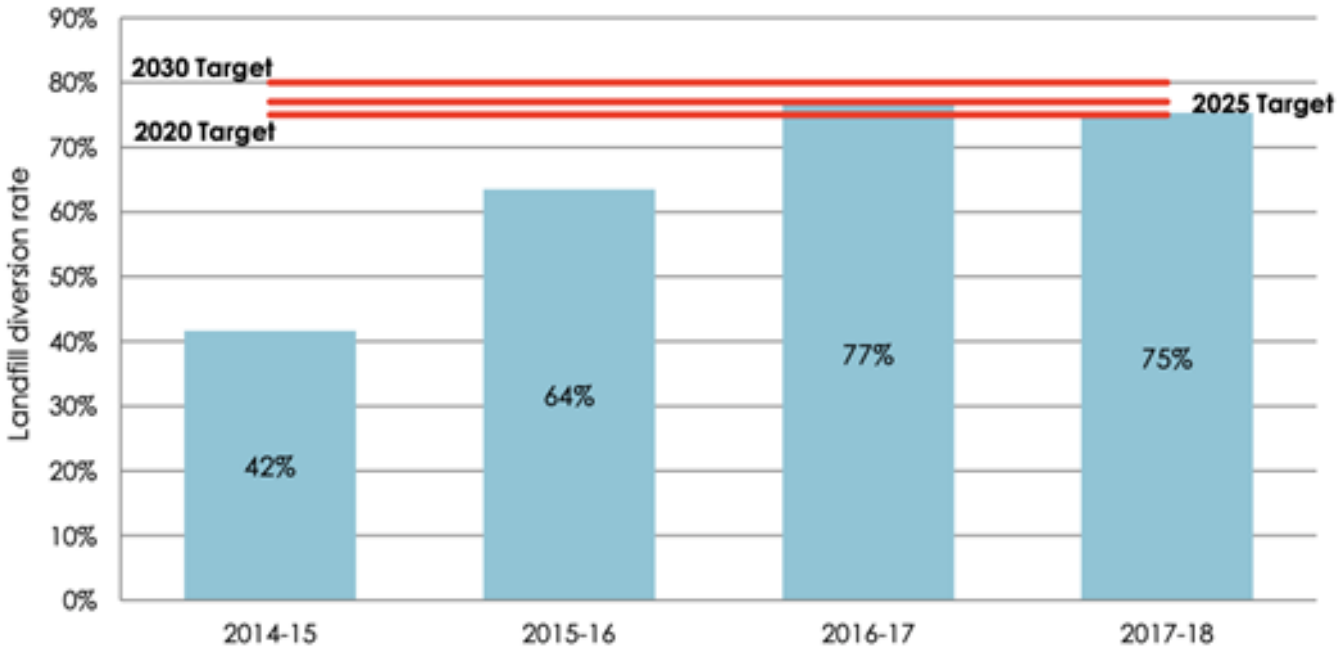


Figure 7 - C&D sector recovery rates and targets (Waste Authority)

C&D WASTE FOR ROAD CONSTRUCTION

To maximise the use of C&D materials in LG and State roads, it is important to identify and understand the barriers involved. A recent survey on the use of recovered and recycled materials in the construction industry revealed that the majority of construction practitioners have limited knowledge on the availability of such materials in Western Australia and could not identify projects using recycled C&D products.

The barriers to the use of recycled materials were identified to be:

- A lack of confidence in the performance of recycled products;
- Concerns over contaminants such as asbestos, heavy metals and poisons;
- Ignorance over product specifications and design procedures;
- Fear of change from conventional techniques and materials; and
- Shortage of C&D materials meeting required standards (MRWA, RtR and IPWEA/ WALGA).

To address these barriers an analysis of the specifications relevant to the use of C&D waste is now presented.

TOWARDS100 IN LOCAL ROADS – REGIONAL ROADS TO REUSE (3R)

HISTORY

In 2019, the Roads to Reuse (RtR) program was coordinated by the Waste Authority to encourage State Government organisations, local governments, regional councils and the private sector to use C&D products in civil applications such as road construction. The objective is to reform collection, sorting and recycling processes to deliver products that meet new specifications and maintain road performance standards.

The refinement of C&D specifications creates an opportunity for the BORR project to set new benchmarks for the use of CRC and recycled fill products throughout the main alignment and associated LG roads and pave the way for its ongoing use in future road projects.

C&D WASTE FOR ROAD CONSTRUCTION

CURRENT SPECIFICATIONS

MRWA Specification

MRWA Specification 501 covers the supply of materials and construction of all types of unbound and modified granular pavement layers, including stabilisation. The emphasis on the use of recycled material within this specification is limited at present as it only covers the use of CRC in the subbase layer for full-depth asphalt pavements. It does not include the use of recycled materials for base courses. The use of RAP in pavements is set out in subsection 501.92.

RtR Product Specification

As part of the Roads to Reuse (RtR) Program initiated by the Waste Authority of Western Australia, a product specification was developed for recycled road base and recycled drainage rock from C&D waste. Recycled C&D products that meet the RtR product specification provide confidence to purchasers about the environmental compliance and sustainability of the material and will no longer be considered a waste for the Waste Levy.

This product specification sets out the following requirements for C&D recyclers:

- Preparation of a Material Acceptance and Sampling Plan (MASP) – a site-specific plan which describes the recycler's processes and procedures; and
- Product sampling and testing requirements – to ensure the product meets the requirements of the specification.

IPWEA/ WALGA Specification

The Institute of Public Works Engineering Australasia Western Australia (IPWEA WA) in conjunction with the Western Australia Local Government Association (WALGA) developed a specification for the supply of recycled road base in 2016. This specification aims at guiding the use of recycled pavement materials largely based on CRC which have not been covered in MRWA Specification 501. It includes environmental requirements for C&D materials (for suppliers) such as an asbestos management plan and guidelines for managing asbestos in C&D waste to differentiate the IPWEA/WALGA specification from others.

To achieve improved structural strength of the base materials, recommended limits on material compositions have been provided such as a 95% limit on crushed concrete for the application in base materials to minimise the effect of shrinkage cracking. This specification also specifies the amount of RAP to be used in pavements according to material class.

C&D WASTE FOR ROAD CONSTRUCTION

3R SPECIFICATIONS

A Recycle First Ring Road (3R) specification is proposed that aims to achieve existing overarching performance standards for LG roads through a more targeted fit for purpose specification. The intent is to deliver recycled materials into local road elements of the BORR that are equal or superior to existing specified materials while also delivering better value for money. These outcomes can be achieved by utilising a different composition of recycled materials in pavements while complying with the RtR environmental specification and building on the strengths of other existing specifications such as the IPWEA/WALGA specifications.

A few key aspects of the specification include:

- Encouraging higher quantities of co-mingled C&D (brick and tile) waste in base and subbase in LG roads and cycle and pedestrian paths;
- Introduction of more material classes (four in comparison to the two in the IPWEA/WALGA specification) to incorporate a wider range of recycled material into the pavements based on performance requirements;
- CRC with a high pH is not recommended for use in the vicinity of a watercourse or on land which is prone to flooding; and
- The requirements of particle size distribution, Atterberg limits and California Bearing Ratio (CBR) are further categorized based on the material classes.

The 3R specification will acknowledge that CRC is suitable to be used as a subbase and as a base under heavy traffic load on certain roads. However, this material should be avoided as a base on an unbound conventional granular material under heavy traffic. It also will also aim to specify the use of inert C&D materials including clay brick and tiles in subbase and also will caution against the potential environmental aspects of C&D materials under unsealed roads.

To further strengthen the concept of Towards100, a 3R training and mentoring program has been proposed to increase industry knowledge and build capability. As part of this program, a toolkit will be developed to build industry capability and bridge the gap in C&D waste recovery knowledge.

C&D WASTE FOR ROAD CONSTRUCTION

KEY FINDINGS

Some key highlights regarding the specifications for the use of recycled materials in pavements are:

- **Co-mingled C&D waste**: IPWEA/WALGA, MRWA and RtR specifications encourage the use of co-mingled C&D waste in pavements. This helps to lower the cost and increase the availability of C&D materials for construction. Suppliers are also able to source information on permissible limits for contaminants and related information from the RtR specification

- **The alkalinity of recycled concrete**: RtR specification cautions against the use of recycled concrete in unsealed road applications due to its high alkalinity. However, roads containing recycled concrete with pH > 9 can be used when sealed which would increase the use of recycled materials in LG roads.

- **Asbestos contamination**: Asbestos contamination is a well-documented problem and still presents a significant issue in waste derived from C&D. The greatest recycling rates can be achieved when the waste materials are captured early and segregated.

- **Performance concerns**: The major risk identified during the use of recycled concrete is the reactivation of unhydrated cement resulting in shrinkage and fatigue cracking under heavy traffic. Therefore, the use of C&D waste is preferred to the use of fresh waste concrete in pavements due to this concern. This promotes the use of C&D materials in pavements due to both the sustainability and performance aspect.

- **Knowledge gap**: IPWEA-WA is currently developing a specifications training course designed to help project managers and engineers responsible for public works understand the specifications of new materials such as recycled aggregates and substitute materials, and to learn how to incorporate them into projects. As the range of products and materials increases there will be a greater need for such courses to provide awareness of materials and, more importantly, knowledge of how to use them successfully in projects.

The limitations of current specifications in relation to the use of C&D materials, especially co-mingled C&D in base course of LG roads, is a major barrier moving Towards100. Clarity regarding working around the alkalinity issue as well as asbestos contamination are particular issues that require resolution to provide certainty for suppliers and contractors. This could be resolved with an exclusive 3R specification for BORR maximising the use of C&D materials in LG roads. The 3R specification aims to encourage the use of recycled materials both in base and subbase for LG roads, cycle and pedestrian paths including CRC, RAP, brick and tile and recycled aggregates. It will also lay out various performance requirements of recycled materials according to material classes.

C&D WASTE FOR ROAD CONSTRUCTION

C&D INDUSTRY TOOLKIT

As was discussed in earlier sections regarding barriers to the increased use of C&D waste, there is currently a knowledge gap in conducting C&D waste collection to provide acceptable quality recycled material to be reused either for road pavements or non-structural precast concrete products. To address this gap, an effective industry toolkit has been developed to build capability at the point of collection and separation of C&D waste to be reused. It is hoped this will enable new skills to be developed in the local workforce especially for local Indigenous people. Aboriginal people represent 3% of the South West population, and their increasing engagement provides a stable foundation on which the region can grow. New jobs and businesses can potentially be created in the field of waste sorting, processing and recycling through the use of this toolkit.

This industry toolkit is intended to support local demolition contractors and recycling companies in developing systems and processes to promote source separation of C&D to provide consistent feedstock for Materials Recovery Facilities (MRF). Critical to this is eliminating hazardous materials (i.e. asbestos and heavy metals) from MRF feedstocks (Figure 8). The following benefits have been realised in other Australian jurisdictions:

- Improved supply chain integrity;
- Higher quality recycled aggregates;
- Increased recycled base and sub-base materials; and
- Reduced C&D volumes going to landfill.

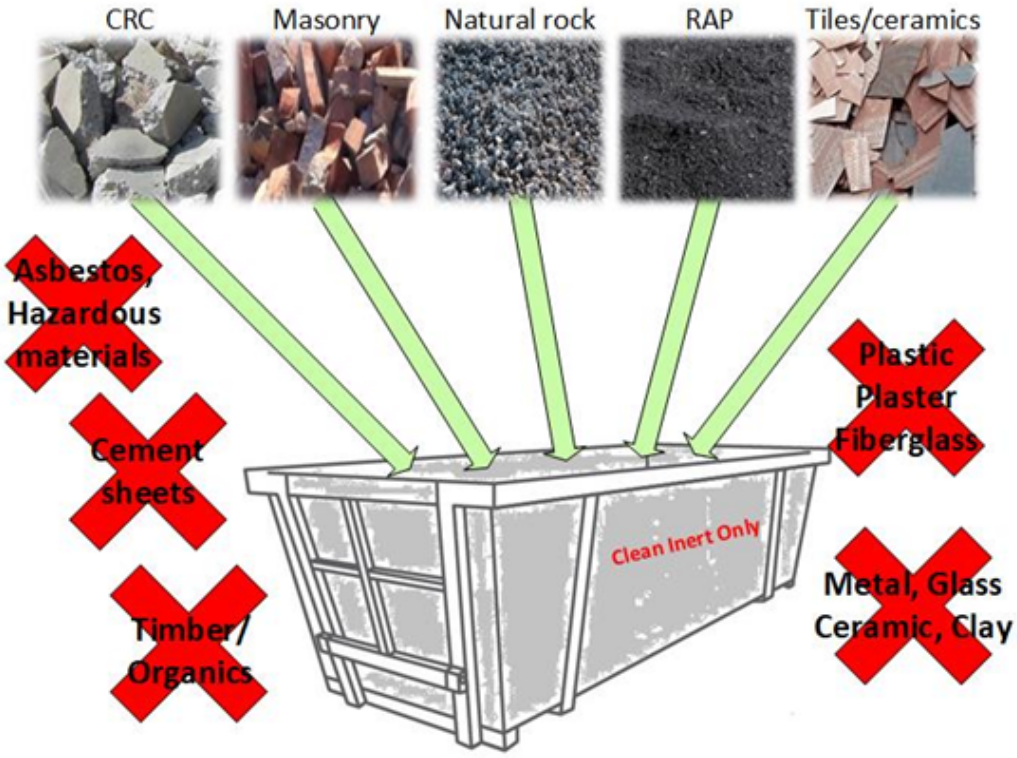


Figure 8 - Source separation of C&D for sub-base material

C&D WASTE FOR ROAD CONSTRUCTION

The effect is a simpler and more efficient processing pathway, supply chain integrity and high-quality end-products suitable for infrastructure applications such as the BORR. This in turn increases industry confidence in the suitability of these materials for base and sub-base materials, as well as precast concrete products. In the first attempt, the toolkit tries to control the types of materials going into MRF by eliminating all hazardous materials (i.e. asbestos and heavy metals) and minimising unsuitable materials for the sub-base layer. The sub-base layer has significant opportunities to accommodate recycled materials. It may contain major quantities of co-mingled inert C&D materials including clay bricks and tiles as is proposed to be specified in the 3R specification. Hence source separation of C&D materials as illustrated in Figure 8 is an important element in keeping out unacceptable materials, and providing an increased amount of recycled sub-base material.

The toolkit also aims to help promote good practices regarding source separation of co-mingled C&D materials to produce suitable material for the base layer as well as recycled aggregates for non-structural precast concrete products. To achieve the improved structural strength for these purposes, a high proportion of crushed concrete is required compared to the rest of the supplementary materials. To achieve this, the toolkit recommends source separation of crushed concrete from other acceptable materials which may appear in the recycled base material and recycled aggregates but in controlled quantities. This means that at the demolition site, a separate skip bin should be allocated only for crushed concrete including concrete bricks, concrete pavers and concrete tiles. Source separation of co-mingled C&D as illustrated in Figure 9 provides recycled base material as well as recycled aggregates as a replacement for virgin aggregates in concrete elements.

Figure 9 - Source separation of comingled C&D for base material and recycled aggregates

C&D WASTE FOR ROAD CONSTRUCTION

The process of C&D waste collection proposed by this toolkit begins with simple, yet critical pre-acceptance actions for recycling companies followed by quality assurance inspections at the point of collection. Pre-acceptance conditions include establishing whether the primary use of the demolition site suggests the likelihood of hazardous materials (i.e. if the demolition site belonged to a petrol station, industrial warehouse with traces of heavy metals, etc.). Acceptable C&D materials are sorted into bins for CRC and 'other inert materials' at the point of collection (as illustrated in Figure 9). This is then quality assured through inspections before collection and transfer to the MRF for further sorting, crushing and screening. Unsuitable materials are diverted to landfill.

Figure 10 demonstrates the inter-related processes of C&D material collection proposed by the toolkit to manage consistent feedstock into a MRF to ensure supply chain integrity.

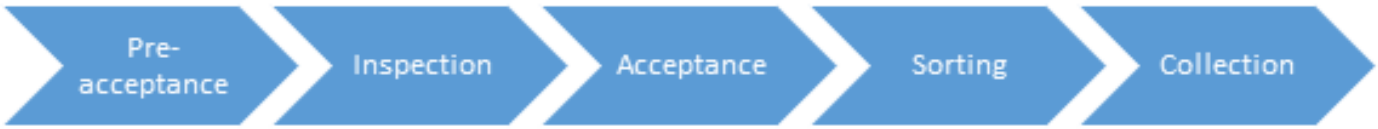


Figure 10 - Inter-related processes proposed by the toolkit for C&D collection

CHAPTER 4: IMPLEMENTATION THROUGH PROCUREMENT AND COLLABORATION

The implementation of the Recycled First Plan and its recommendations requires a stepwise process. Critical to this is procurement. Provided supply chain integrity and recycled products consistently meet specifications, broader governance issues should not arise.

The BORR project is a waste generator and consumer of recycled products. Behaviour change initiatives supported by the toolkit will be required to ensure waste materials can be recycled for reincorporation into the project. Collaboration between SWGA, SWA and contractors will be essential to a successful outcome as these changes will be implemented when the project is delivered. It is proposed that this process continue post-BORR to ensure the lessons learned continue to drive greater uptake of recyclables into future road projects.

THE IMPLEMENTATION PROCESS

The BORR project has a number of objectives, including successfully delivering the project and leveraging its procurement profile to develop additional capability within the South West waste recovery sector. The following process is proposed, to enable the achievement of these aims in parallel:

1. Engage with local contractors to establish on-site sorting infrastructure and transport of BORR C&D materials to a central local facility for recovery and recycling back into the project.

2. Adapt BORR procurement mechanisms to enable the substitution of recycled materials for virgin materials as specifications are developed and the suitability, quality, cost and volume of recycled materials inputs is confirmed.

3. Adopt the initiatives listed in this RFP to enable the development of specifications and supply chain interventions required to deliver high quality recycled and reused materials to the BORR.

4. Confirm the capacity, investments, timing and supply chain interventions required to enable suppliers to supply the BORR and to enable project planning to anticipate recycled material types, costs, and quantities.

IMPLEMENTATION THROUGH PROCUREMENT AND COLLABORATION

5. Benchmark recycled materials cost elsewhere as the basis for commercial arrangements designed to increase or improve local industry capacity to supply recycled materials to the BORR.

6. Establish strategic partnerships to enable commercial arrangements that create new capacity and deliver higher volumes of recycled products to the BORR. This may involve a combination of capital investments and subsidised offtake pricing and volume commitments to deliver value for money to the BORR. For example:

- South West FOGO facilities must be expanded to meet BORR demand.
- Additional C&D crushing plant infrastructure is required to deliver sufficient inert CRC and fill at the required specification.
- Glass crushing infrastructure is required to achieve the anticipated RCG specification.

TOWARDS100 IN LOCAL ROADS AND PROCUREMENT DURING, AND BEYOND, BORR

Local roads built by the BORR project will be handed over to LG. It will be important that the roads are fit for purpose and consistent with the policy objectives of LG. The 3R specification can also be adopted when they:

- conform with RtR environmental obligations;
- deliver greater sustainability and recycled material content; and
- achieve a better Towards100 outcome.

To assist LG in taking these positive steps, reforms in the areas of procedures and procurement are recommended.

IMPLEMENTATION THROUGH PROCUREMENT AND COLLABORATION

PROCEDURAL REFORMS

The real-time nature of the BORR project means procedures will need to be developed quickly. Since internal LG procurement decisions are easiest to inform procurement processes, a first step would be a Council direction to achieve a minimum target of recycled content in the various parts of road construction (spray seal, base, subbase, kerbing, ancillaries) – whether in maintenance or as a conditional approval on later development applications. This direction can anticipate future increases to the targets to support the viability of new recycled materials' infrastructure investments and publicly communicated to progress the intent of Towards100. Achieving this requires projecting existing construction and maintenance needs for the LG area and the suitability of recycled materials for various road construction purposes.

Targets can be set with four strategies:

- **Fixed fraction:** setting a specified percentage of recycled content to be present in each aspect of road construction
- **Fixed financials:** setting a specified percentage of the total project budget to be spent on recycled content in aspects of road construction
- **Fixed Impact**: setting a specified reduction in environmental impact.
- **Fixed ISCA scores** (or equivalent)**:** Alternatively, LG could mandate a minimum ISCA standard (silver, gold or platinum) or score for each section of road procurement.

The strategy prioritised by Towards100 is the flexible use of a standardised sustainability assessment rating system (e.g. ISCA) with independent, internal audits of the outcomes of each project. This takes advantage of the structure and thoroughness of a pre-vetted and tested system, and by adopting such a strategy would allow an immediate influence on the BORR project.

IMPLEMENTATION THROUGH PROCUREMENT AND COLLABORATION

Specific procurement provisions will be required to enable the substitution of recycled products as new recycled product specifications are developed and suppliers demonstrate the capacity to deliver useful quantities at competitive prices, within BORR timeframes and without negatively affecting performance against established standards. The range of possible recycled products is known and can be accommodated in advance. The objective is to minimise the impact on project development timeframes and avoid changes to project governance systems and plans.

A possible procurement reform process to guide the introduction of the above provisions would be one analogous to that shown in Figure 11.

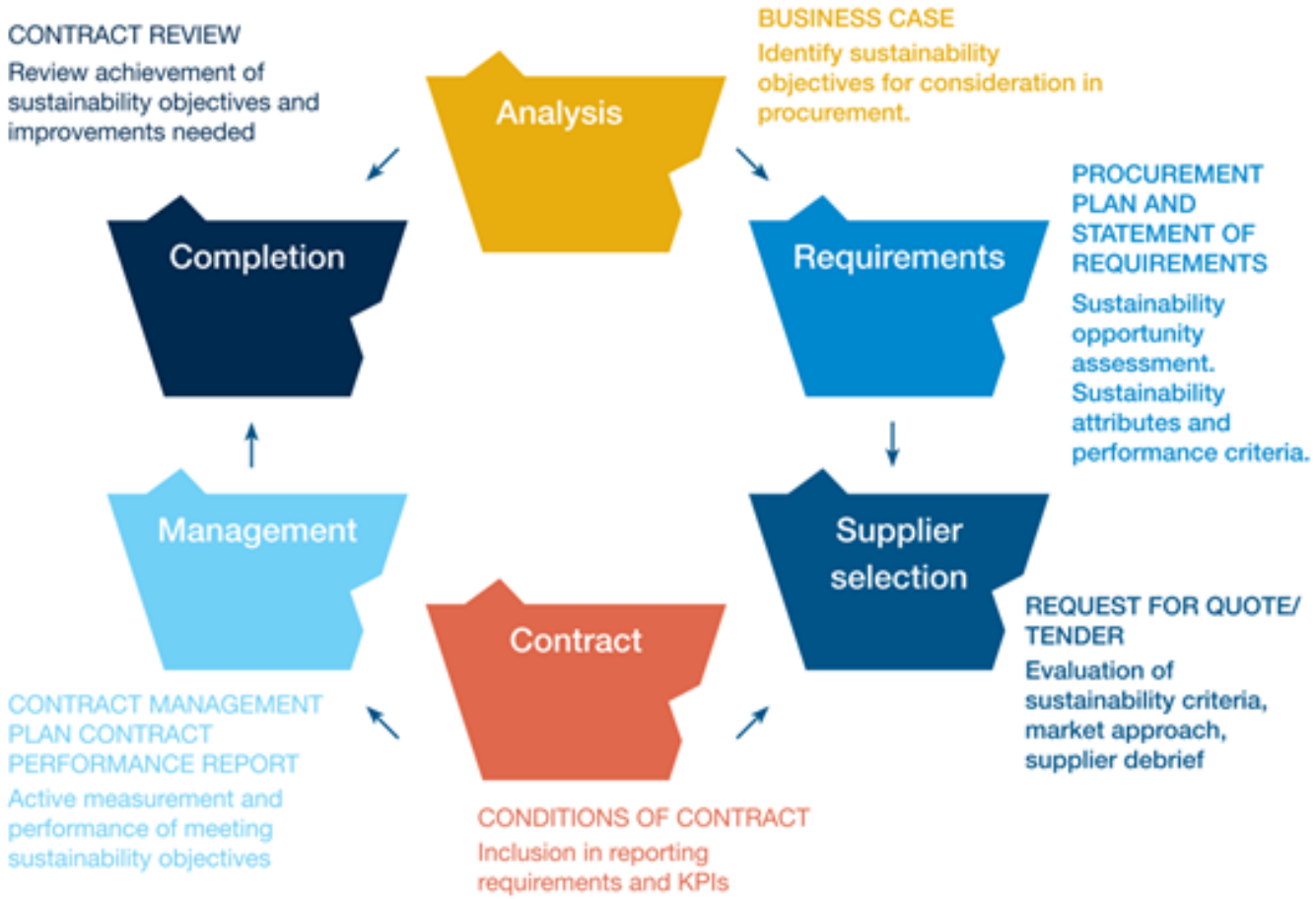


Figure 11 - Sustainable procurement reform process

IMPLEMENTATION THROUGH PROCUREMENT AND COLLABORATION

COLLABORATION PRINCIPLES

To promote discussion and open-minded collaboration that will drive positive outcomes, a collaborative approach is proposed with a focus on:

- The six main waste stream opportunities for recycled content.
- Accessing and further developing the considerable knowledge, experience and technical expertise that resides within SWA and SWGA for the best outcomes for the BORR Project.
- Removing any duplication of effort and effectively utilising the resources that become available for the collaboration.
- In-roading elements of the SWA Innovation Hub into the SWGA as its mechanism to deliver innovations that are fit for purpose and value for money for the BORR project.
- Jointly promoting and focussing on additional relevant areas of mutual interest as they arise.
- Establishing a streamlined procurement process that facilitates early understanding of resource and funding commitments from each of the parties.

CHAPTER 5: CONCLUSIONS AND RECOMMENDATIONS

The implementation of this Recycle First Plan along with its recommendations requires a paradigm shift in thinking to deliver the maximum amount of recycled content into BORR and future road infrastructure projects. Six waste streams have been identified to be viable options with some applications being prioritised as key action items.

A 3R specification has been proposed in this Plan with the intent of delivering the maximum amount of recycled materials through encouraging a greater use of C&D materials. A 3R training and mentoring program, and toolkit have also been presented to build awareness, industry capability and create jobs in waste recovery. These tools and resources are aimed at equipping relevant waste industries with the required information and knowledge to achieve maximum waste material recycling.

The successful implementation of the Recycle First Plan and its recommendations are strongly driven by behavioural change initiatives supported by the tools and resources proposed as well as procurement mechanisms. A collaborative relationship between SWGA, SWA and waste contractors is crucial to a successful outcome and adopting the philosophy Towards100.

A list of recommendations is provided along with this Recycle First Plan:

1. Crushed Recycled Concrete (CRC)

1.1. Maximise the use of CRC in retaining walls and precast concrete products. Technical assistance to be provided to local manufacturers of precast concrete products and retaining wall blocks to develop suitable concrete mix designs to facilitate the use of this waste product.

1.2. Implement knowledge transfer opportunities between experienced recyclers and local/ regional small-scale recyclers to ensure capacity and supply chain integrity leading to greater consistency of supply of this material.

1.3. Explore the different properties for backing blocks (cement content) and face blocks.

1.4. Identify potential non-structural units such as blinding layers, footpaths, median barriers and extruded kerbs and others elements that may be appropriate and prepare a supporting draft specification in collaboration with MRWA.

CONCLUSIONS AND RECOMMENDATIONS

2. Recycled Crushed Glass (RCG)

2.1. Utilise RCG as a decorative feature in concrete noise walls, paths, and concrete infill/paving.

2.1.1. Investigate improvements required to the local supply chain to ensure characteristics and properties are suitable to achieve a higher value end product.

2.1.2. Evaluate the sustainability of the use of RCG for decorative concrete considering its high embedded energy, water consumption and cost involved.

2.2. Building on WARRIP research, develop a potential use of RCG as a capillary rise drainage protection layer.

2.2.1. Develop an optimised grading envelop for the product for testing in collaboration with MRWA.

2.2.2. Develop a draft specification for RCG to be used as a drainage blanket on BORR at selected locations where lowering embankment height gives significant flow on cost savings.

2.2.3. Develop a collaborative relationship with the local recycling industry to produce a product that meets requirements.

2.3 Use RCG as a partial replacement for virgin materials in asphalt and concrete.

2.3.1 Use as partial sand replacement in concrete or asphalt pavements.

2.3.2 Use as a potential partial replacement for crushed rock basecourse in LG roads.

3. Lithium By-product (Delithiated Beta Spodumene - DBS)

3.1. Identify ways to use DBS as a fill material or as a stabilising agent for marginal materials.

3.2. Identify ways to use DBS as a partial replacement of cement in non-structural precast concrete (rather than fly ash).

3.3. Evaluate the unit cost to site including transport and handling cost.

3.4. Explore DBS material quality with a focus on pH, contaminants, the potential for ground water plumes, heavy metals, etc.

CONCLUSIONS AND RECOMMENDATIONS

4. Co-mingled inert C&D material

4.1. Adopt a higher proportion of co-mingled C&D material (brick and tiles) as a more cost-effective fill in subbase under sealed pavements.

4.2. Explore the potential of long-term degradation of locally sourced brick and tiles into clay and what affect that may have on the performance risk profile.

4.3. Prepare a revised specification and procurement protocols for LG roads to encourage the use of recycled C&D waste that fully conforms with the DWER RtR environmental requirements (i.e. 3R specification) and supports an ongoing market for these materials.

5. Rubber

5.1. Implement construction scheduling and design process changes to maximise the amount of crumb rubber utilised in wearing courses.

5.2. Adopt end of life tyres in embankments for slope stability.

CONCLUSIONS AND RECOMMENDATIONS

6. FOGO

6.1. Develop a supply schedule for BORR to inform local industry so they have greater certainty around any investment they might make to create an additional supply of FOGO to drive value for money outcomes.

6.2 Explore up-front investment in FOGO processing with BHRC to ensure certainty of supply on value for money grounds.

7. Recycled Plastics

7.1. Utilise recycled plastics in ancillary infrastructure including handrails, decking. paths and geogrids.

8. Wastewater

8.1 Conduct a market survey to analyse the market and, provide treated wastewater to the BORR project at maximum security of supply and wastewater quality.

8.2 Develop an integrated wastewater management plan that is aligned with water and waste management for the entire catchment / region to drive collaboration between industries and potential users of treated wastewater.

CONCLUSIONS AND RECOMMENDATIONS

9. Implementation:

9.1 Adopt the initiatives listed in recommendations 1-8 above to enable the development of specifications and supply chain interventions required to deliver high quality recycled and reused materials to the BORR.

9.2 Adopt BORR procurement mechanisms to enable the substitution of recycled materials for virgin materials as specifications are developed and the suitability, quality, cost and volume of recycled materials inputs is confirmed.

9.3 Collaborate with the SWA Innovation Hub to fast track the implementation of the recommendations including sustainability innovations that offer strong value for money outcomes.

9.4 Confirm the capacity, investments, timing and supply chain interventions required to enable suppliers to supply the BORR and to enable project planning to anticipate recycled material types, costs, and quantities.

9.5 Benchmark recycled materials costs elsewhere as the basis for commercial arrangements designed to increase or improve local industry capacity to supply recycled materials to the BORR.

9.6 Establish strategic partnerships to enable commercial arrangements that create new capacity and deliver higher volumes of recycled products to the BORR. This includes exploring opportunities with BHRC as part of the SWRWG to provide waste management services to the BORR Project to optimise waste diversion, recovery and recycling outcomes and support ongoing LG investments in the SWA Innovation Hub waste supply chain improvements.

FACT: FOR EVERY 10,000 TONNES OF WASTE RECYCLED, 9.2 JOBS ARE GENERATED COMPARED TO 2.8 JOBS FOR LANDFILL

(Source: Access Economics 2019 Employment in waste management and recycling report for the Department of the Environment, Water, Heritage, and the Arts)

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