

Report for Stonnington Council

Recycled Content in Infrastructure and Building Products

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EDGE

Project Delivered for the City of Stonnington and the Eastern Alliance for Greenhouse Action (EAGA)

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Executive Summary

Circular economy provides a framework to design out waste and pollution, maximise value from resources using closed-loop systems, and regenerate natural systems. While the sustainability community across the built environment in Australia has a good understanding of what circular economy is and its potential benefits, there is currently limited knowledge and awareness on the concepts and solutions across the broader sector. This is perceived as the major barrier to widespread progress.

Up until now, other sustainability priorities, such as reducing carbon emissions, have tended to take precedence and have left circular economy as a lower priority. This is despite the role that circular economy solutions can often play in supporting other objectives. Examples of innovation have tended to happen at a project level, in the form of pilots and trials, as a part of broader sustainability goals. Circular economy has yet to become a mainstream part of organisational-level objectives and strategies.

Local government councils collectively represent significant buying power playing a critical role in the reduction of emissions and circular economy opportunities in Melbourne's east. Sustainable and circular procurement will help councils to achieve long term, value for money and enable council spending to not only reduce adverse social, environmental, and economic impacts but also to increase the uptake of recycled materials in infrastructure and building products.

All councils are required to apply good governance and ensure that their procurement processes seek to achieve "value for money" outcomes. Value for money means selection of the most optimum combination of life-cycle costs and benefits which meets the need of procurement. Achieving value for money demands a comprehensive evaluation and must consider the relevant financial and non-financial costs and benefits, for example quality, fit for purpose, environmental and social sustainability and whole of life costs. To-date EAGA member councils are unable to answer if recycled content and/or more sustainable materials are more or less expensive due to a lack of information collected during the evaluation process and/or throughout the project (see section 1.4.1 Limitations for more information). In addition, there are so many variables that influence the cost of materials from volume of the materials to the supplier and the scale of the project (which influence unit costs), that the project team was unable to empirically conclude whether the incorporation of recycled content is cheaper than virgin materials (see section 5.1.4 Limitations).

Due to these limitations, this project involved the development of an Alternative Materials Multi Criteria Decision Analysis tool to support councils to incorporate life-cycle costings and accommodate the unique variables associated with council buildings and infrastructure. The tool includes the criteria and research for the top five materials identified in this project, and allows councils to adapt and amend for other products.

Key findings and recommendations for EAGA member councils to address barriers and increase adoption of circular economy practices and an uptake of recycled content in buildings and infrastructure are:

- Promote existing and build new technical resources and communicate across councils.
- Share knowledge, promote successes and build communities of practice.
- Build a culture of recycled content and sustainability champions and supporters.
- Collect lifecycle costs in the procurement process and evaluate to quantify reduced whole of life costs.
- Share product performance outcomes of recycled content pilot projects.
- Promote the Victorian Government Buy Recycled website and supplier directory to connect local suppliers with local council buyers.
- Specify recycled content percentages and circular economy outcomes to avoid legal constraints related to proprietary products.
- Create regional contracts to aggregate council spend and increase influence to shift the market.

- Ensure strategic alignment across council and regional policies, design guidelines, and processes to remove internal council barriers to adoption.

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1 Introduction

The Eastern Alliance for Greenhouse Action (EAGA) is a formal collaboration of eight councils working together on regional programs to increase the uptake of recycled materials in council infrastructure and building projects across the region with the goal of reducing greenhouse gas emissions to facilitate regional adaptation.

The City of Boroondara, Glen Eira City Council, Knox City Council, Maroondah City Council, Monash City Council, City of Stonnington, Whitehorse City Council, and Yarra Ranges Council, purchase large quantities of building and infrastructure materials and play a critical role in the recovery of materials for recycling.

1.1 Project Objectives

The purpose of the Recycled Content in Council Buildings and Infrastructure project is to identify the barriers and opportunities in knowledge and current practice within EAGA member councils to identify and implement suitable alternative materials of the five (5) highest spend products across the EAGA member councils, to increase the adoption of recycled materials. The project is a Sustainability Victoria initiative in support of the Recycled First Local Government program which aims to:

- Support councils to align procurement activities with the Recycled First Policy
- Accelerate council adoption of recycled products in infrastructure and landscaping
- Encourage councils to test and try recycled products
- Reduce barriers to the procurement of recycled products
- Challenge misconceptions of recycled materials and products and promote benefits

This project will support the reduction of emissions and circular economy opportunities in Melbourne's east by:

- Addressing the existing barriers to the use of reusable and recycled construction materials in council building and infrastructure projects
- Building the capacity of council procurement, project design and delivery teams in the sourcing, procurement, and use of sustainable recycled content alternatives to a range of commonly used building materials for infrastructure projects
- Avoiding waste to landfill and increase the volume of materials that are reused
- Supporting markets for recycled materials

This report is intended to compliment the Sustainability Victoria [Recycled Products and Materials - Procurement Toolkit for Recycled Products and Materials](#).

1.2 Project Methodology

A review of council infrastructure and building project information was undertaken to establish an inventory of frequently used materials across the region. Stakeholder interviews were conducted with EAGA member councils, Sustainability Victoria, and a key infrastructure partner.

The process involved the analysis of the technical considerations of potential suitable alternatives to ensure they are fit-for-purpose and meet performance requirements and standards.

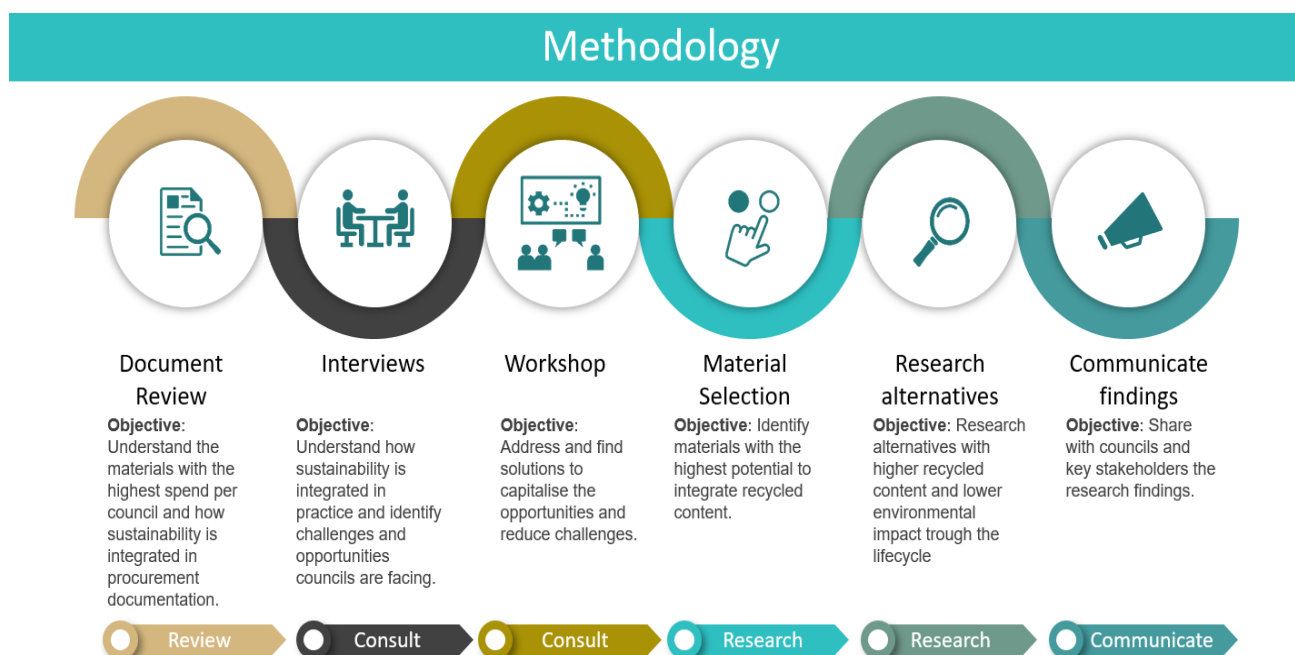


Figure 1 Project Methodology

1.3 Desktop Review

Each of the eight participating EAGA member councils were asked to provide existing documentation and data in project discovery phase to conduct a gap and opportunity analysis by council. Where documentation was not provided, publicly accessible information was accessed and reviewed across 4 strategic types of internal levers:

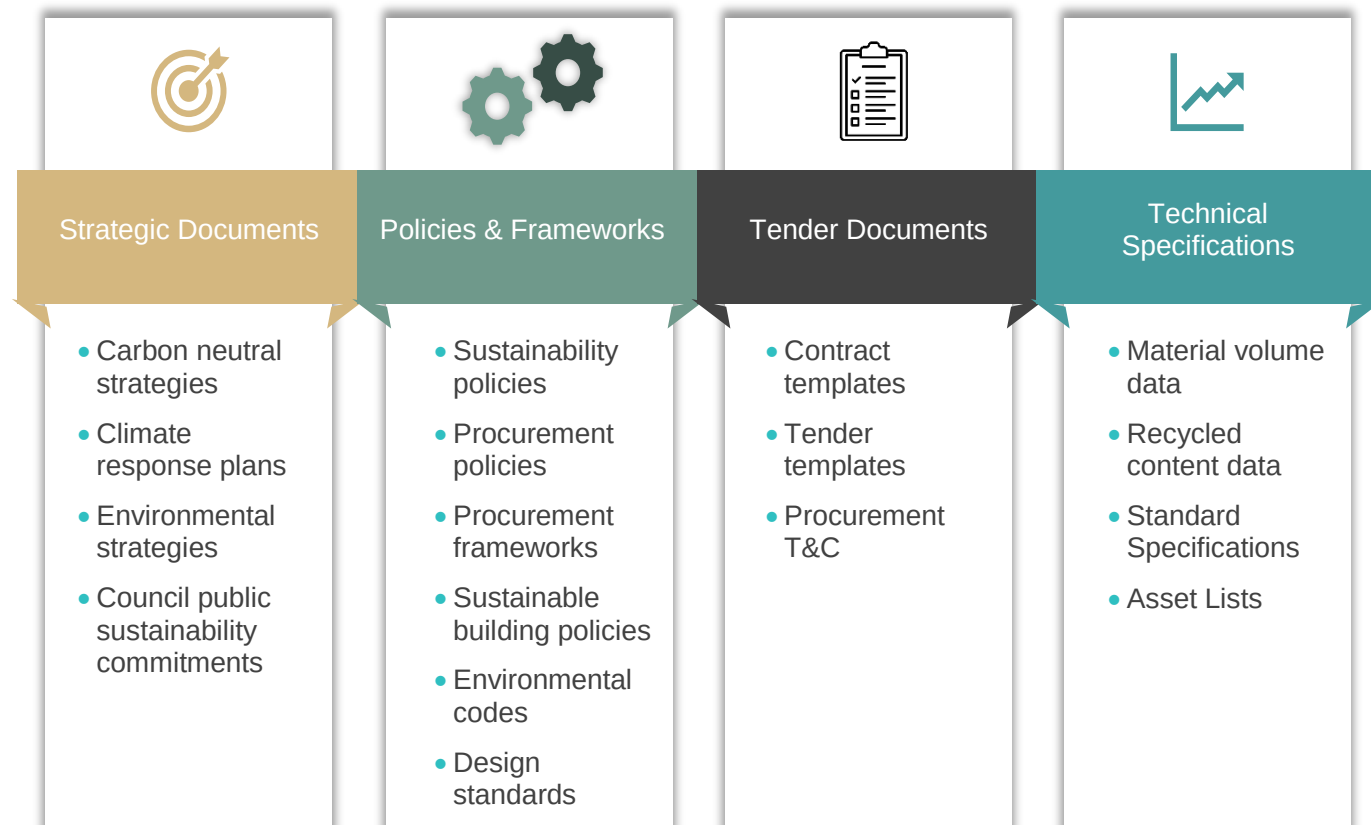


Figure 2 Documentation Assessed in Desktop Review

1.4 Council Interviews

Semi-structured interviews were conducted with representatives from each of the eight councils, Sustainability Victoria and a recycled material content supplier.

The objective of the interviews was to:

- Identify the top 20 most common products/materials used in building and infrastructure projects materials by spend and/or quantity procured by each council
- What current recycled materials and/or products were in use
- Understand current procurement practices, barriers and opportunities to increase recycled content and circular economy outcomes.
- Product evaluation – how and what is assessed? What lifecycle and performance considerations are included?
- Gather information about recycling and circular procurement initiatives to identify case studies and good practice
- Supplier and market engagement and performance management practices.

The information received from the interviews, combined with the insights from the desktop review, identified the top 20 building and infrastructure spend categories, prioritised into five (5) highest impact product or materials (see 4.2 Councils Highest Impact Materials of this report). The interviews also identified good practice examples of the use of recycled and reusable materials already implemented, with some councils having established circular procurement tools and processes, while other councils are at the beginning of the circular procurement journey.

1.4.1 Limitations

Granular data on material type, volume, spend per unit or annual spend in some instances was not provided or captured from councils, suppliers or contract managers, undermining the opportunity to provide a detailed, material cost benefit analysis. As a result, assumptions due to available data limitations were, by necessity made. The reason that information such as material volumes or spend by volume was not provided by councils is because they largely do not collect it, nor do they require their contractors to collect or report on it.

1.5 Council Existing Practice

EAGA council members have established strategic imperatives to achieve sustainable outcomes through circular economy principles; the majority of councils have policies and processes in place to support the transition, in some cases with circular project trials underway.

The mature councils are embedding circular criteria in key performance indicators (KPIs), tenders and sharing their experience with other councils to facilitate progress on sustainability goals.

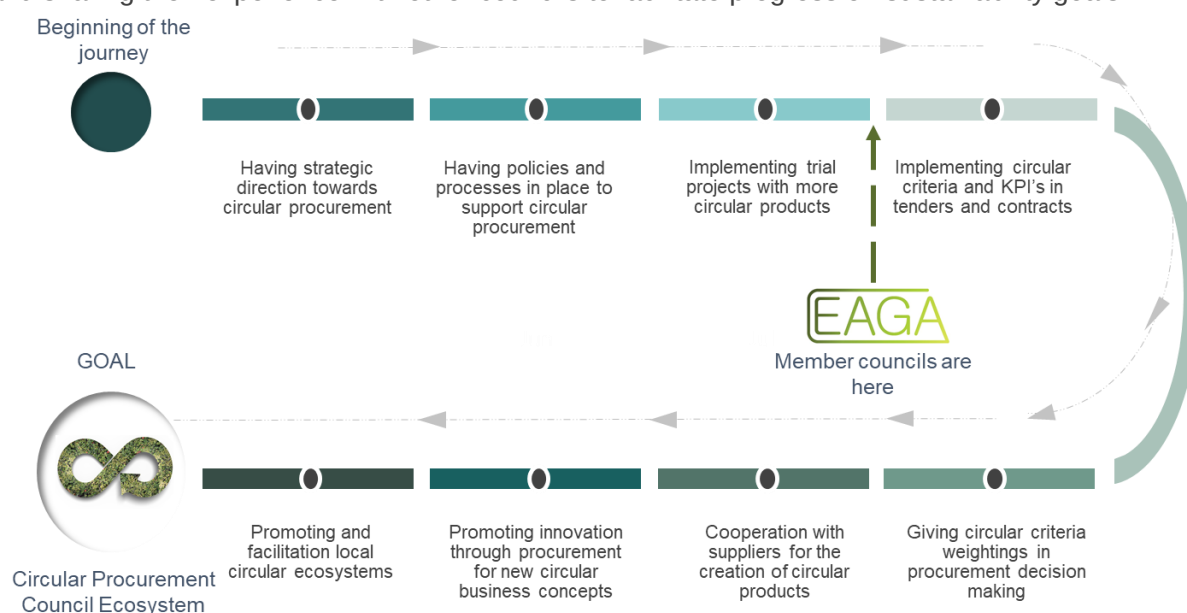


Figure 3 EAGA member councils circular economy journey

1.5.1 Areas of opportunity within the existing procurement process

A key finding of this project is that it was not possible to empirically demonstrate whether the incorporation of recycled content into council works increases or reduces project costs over their life cycle. The primary reason for this is that councils simply do not collect data on itemised materials costs and quantities for many council projects. This significantly hinders councils' ability to quantify the cost and volume of existing materials use, making predictions around recycled content incorporation, difficult.

Further, there are so many variables that influence project costs, such as volumes, project scale (which influences unit costs), availability of materials (including recycled materials), the maturity of the market, the location and source of materials, and transport costs, that this project was not able to empirically demonstrate whether the incorporation of recycled materials increases or reduces project costs over their lifecycle.

Another finding was that there are mismatches between council ambitions on sustainability policy and practice. While most councils have strategies, policies and environmental design documentation that reference recycled materials, there is often limited connection to how these outcomes can be achieved through the procurement process.

Building on the existing council sustainability and circular economy objectives by minimising the use of virgin material and incorporating recycled material requirements in all tender or quotation documentation will enhance existing high-level inclusions in procurement documentation.

All council documentation reviewed, referenced the principles of value for money and life-cycle assessment of costs. Establishing mandatory recycled content evaluation criteria, minimum percentages of recycled material content, and utilisation of the EAGA Alternative Materials Multi Criteria Decision Analysis tool (see 5 EAGA Alternative Materials Multi Criteria Decision Analysis tool) will increase adoption of recycled content across the EAGA member councils.

The table below provides a high level overview of existing documentation that can be updated to link circular economy and recycled content intention into procurement practice.

Council	Opportunities
City of Boroondara	Procurement documentation refers to recycled content as a way to achieve environmental outcomes.
Glen Eira City Council	Procurement policy asks to consider recycled content, stating 10% higher purchase price is acceptable. Sustainable building and infrastructure policy also includes specifying recycled content in building, infrastructure and construction materials wherever feasible. It also specifies low carbon concrete and recycled material % in aggregate wherever feasible.
Knox City Council	The procurement policy provides a 10% weighting for recycled and environmentally preferable products in the procurement evaluation process
Maroondah City Council	Procurement policy links sustainability to the value for money objective.
Monash City Council	Procurement policy clearly includes sustainability and whole/lifecycle costs as an imperative and that council will ensure that material standards used in specifications are updated to reflect innovation and increased use of embedded recycled content, reduced carbon footprint and/or reduced environmental impact from disposal. Monash City council documentation is considered the highest maturity in all councils reviewed.

City of Stonnington	Existing procurement policy links sustainability to the value for money objective. Draft South East Regional Group of Councils procurement policy specifies recycled content and clearly includes environmental and recycled content objectives. Draft sustainable assets policy includes explicit % reduction of embodied carbon and recycled content of materials by asset type
Whitehorse City Council	Procurement policy includes mandatory sustainability evaluation weighting and preference to recycled products. It also includes the council objective to increase the use of recycled products. Council design guidelines included recycled content by material type and construction site waste target to recycling.
Yarra Ranges Council	Procurement manual references the sustainability framework and recycled content as a key consideration. Examples of considerations across the types of goods and/or services include recycled materials.

1.6 Behaviour change findings and recommendations

The project team conducted a behavioural change workshop to identify levers for material changes across councils. Findings suggest a disconnect between sustainability intent articulated in broader council strategies and the action required through policy reform. For strategic sustainability objectives to be successful it is crucial that strategy is integrated into both policy and practice.

1.6.1 Common barriers across councils

EAGA members face similar challenges to many local government councils around Australia when implementing and embedding circular economy in project design and procurement processes. Connecting the sustainability ambition of each council to the procurement process, cascading to requiring information in supplier responses in the evaluation phase and subsequent obligations throughout the project is ad-hoc across councils.

As barriers are present regardless of the maturity of circular economy implementation, identification and proactive management could lead to additional opportunities for collaboration, increasing the uptake of recycled materials.

Barriers identified through interviews include:

- **Lack of resources:** Councils lack the budget or the staff to implement circular procurement programs with concerns that focusing on those programs may divert resources from other areas.
- **Knowledge:** Council staff lack knowledge about products to achieve circular procurement outcomes.
- **Culture:** Sustainability champions and supporters encounter internal pushback as circular economy and sustainability disrupt the business-as-usual approach.
- **Price constraints:** Despite usually having lower lifecycle cost, sustainable or circular products may have a higher initial purchase price.
- **Product performance:** There is a perception that recycled products do not meet the required performance requirements over the lifespan of the product or asset, as traditional or virgin materials.
- **Product Availability:** Circular or sustainable alternatives may not be widely available locally or within Australia.
- **Legal:** Competition rules can prevent councils from specifying specific products when few market players.

- **Councils are small market players:** Councils procuring products individually can inhibit their ability to influence the market.
- **Policy:** Many councils listed internal policies, such as climate emergency declarations, sustainable buildings, and ESD policies as some of the biggest influencers of change for recycled content uptake.

Common barriers to increasing adoption of recycled materials in the procurement process include:

- **Design and tender brief:** Design guidelines that specify a minimum recycled % and content by material are not included in the procurement process.
- **Tender and Contract specifications:** Product specifications are not required during the procurement process to evaluate product content and sustainability performance.
- **Tender assessment criteria and measurement and evaluation frameworks:** A lack of mandatory sustainability evaluation criteria in the procurement process, or if it does exist, is 5-10% of the total
- **Contracting:** Essential supplier data such as origin of materials, bill of quantities/materials information is not requested from head contractors and therefore recycled content is not being contracted, tracked and reported against.
- **Project review and completion:** Evidence of recycled content and/or value for money outcomes in post-implementation reviews were not provided.

1.6.2 Recommendations

Throughout the interview process the consistent themes of the willingness and interest of council staff to adopt circular economy principles, trial new products with recycled materials, and build on current initiatives to integrate within the procurement process were reiterated. With local suppliers receiving clear market signals on the need for greater availability of material alternatives with recycled content and sustainability priorities, availability of options in the Australian market has dramatically increased in recent years and that trend will continue.

Procurement exists within a broader council sustainability and circular economy framework, to enable the achievement of their recycled content and circular economy objectives within the procurement process, there are four significant areas where EAGA member councils should focus:

- **Communicate:** Include and communicate circular economy goals, objectives, and targets within council's governance framework (Strategic Plan, Risk Management Framework, Sustainability Policy, Sustainable Procurement Policy and Supplier Code of Conduct). Councils' strategic goals and objectives will need to be communicated detailing how these goals and objectives will be put into practice.
- **Identify and prioritise sustainability risks:** Create circular economy priorities at the category level to determine where the effort and focus should be directed. Councils should develop specific category guidelines and training to support staff to both identify circular economy risks and opportunities and to also assess suppliers' sustainability credentials in the evaluation stage.
- **Procurement and Supply Chain Management:** Set clear minimum and aspirational circular economy requirements for suppliers, (including relevant specifications, criteria and standards), and encourage suppliers to challenge the requirements if they can see opportunities to improve circular economy outcomes (e.g. through innovation clauses). Councils can use the procurement process to have subject matter experts (the suppliers) provide insights to council on what can be achieved and who is willing to work with them to get there.
- **Post implementation reviews:** Project reviews after completion of the project are equally as important as the tender and contract process. The development and integration of a project review process enables councils to close the loop on the recycled materials used in infrastructure and construction projects. The inclusion of a project review and follow up process holds suppliers to account of sustainability and product performance claims and enables future learning to aid continuous improvement.

- **Reporting:** To achieve a consistent approach to collecting data and measuring sustainable spend, councils should map circular economy priorities and objectives for the region to the Sustainability Victoria state targets and framework. Only then can councils develop standardised metrics, collection forms and data collection/storage. It is easiest to begin by using simple metrics for data capture and circular economy performance measurement to establish a baseline; these can evolve as maturity about circular procurement increases between councils and suppliers. At the time of writing, key performance indicators (KPIs) for circular procurement have not been set by any council.
- **Knowledge sharing:** High-profile projects should be promoted by councils to communicate the benefits of policy changes and process approaches to encourage increased adoption of practices. The establishment and engagement of an infrastructure panel, featuring council representatives, community, and infrastructure and construction experts, would also facilitate knowledge and good practice sharing. To overcome the potential lack of technical knowledge and experience in using recycled materials, in terms of suppliers and internal staff, promotion of communication material from the Sustainability Victoria Buy Recycled website, technical product information and case studies from local, national and international projects will aid understanding and uptake.

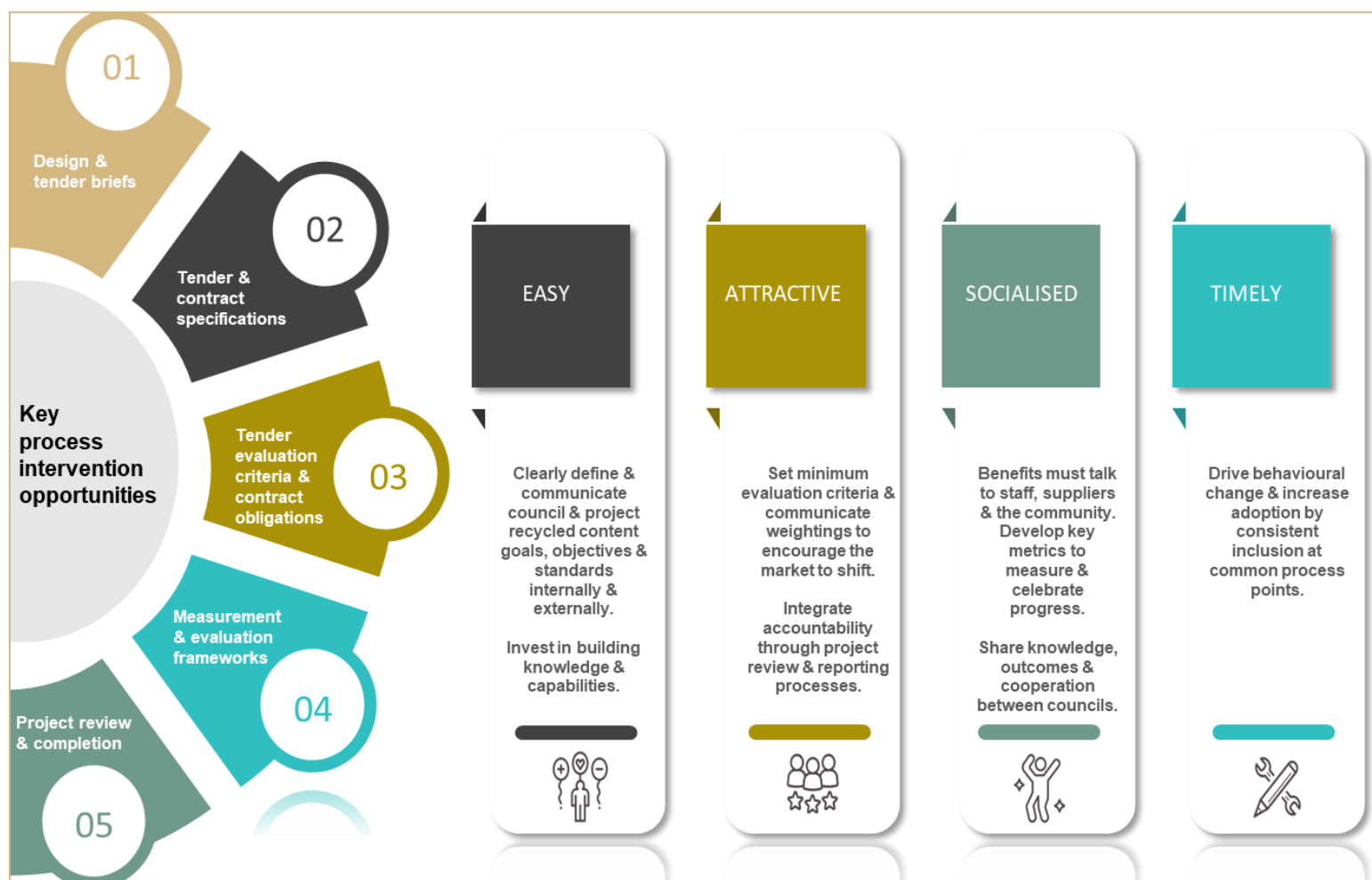


Figure 4 Behavioural change key opportunity findings

For more information on circular economy opportunities in the procurement process see 3 Integrating Circular economy into Procurement

2 What is circular economy?

Circular economy is a framework to use and manage materials required to meet the needs of society in such a way that does not deplete finite resources, retains value in closed-loop systems, and regenerates degraded ecological systems. To achieve this, the circular economy framework provides the following [three guiding principles](#):

1. Design out waste and pollution – around 80% of waste and pollution that occurs across the lifecycles of products and materials is determined at the design stage. Through careful design decisions, waste and pollution can be avoided in the first place.
2. Keep materials in use – in a linear economy, valuable materials and resources are lost at the end of their life. A circular economy aims to keep materials in use for longer, therefore maximising the value we get from them. Examples of strategies to keep materials in use for longer include designing durable products, repairing broken products, and recycling component materials to make new products.
3. Regenerate natural systems – for a long time, humans have been extracting resources from natural systems, and polluting natural environments. A circular economy aims to restore and regenerate ecosystems so that we improve rather than deplete the value of natural resources.

Some of the benefits that can be achieved through a circular economy are a reduction in carbon emissions, more value realised from resources, more resilient and collaborative ways of delivering products and services, living within planetary boundaries while providing safe and equitable social foundations. Circular economy directly connects with delivering on several of the United Nation's Sustainable Development Goals, picture in Figure 5.



Figure 5 Sustainable Development Goals enabled by circular economy

2.1 Enablers of circular economy transformation

Achieving a circular economy involves new ways of thinking, designing not only for the user but for the whole system within which the design exists, exploring new business models to extend the life of products and build-in accountability for end-of-use management.

There are [several design principles](#) that can assist in achieving circular economy and reduced whole of life impact, including:

- Design for the multiple uses at the highest value– such as reuse, sharing, remanufacturing and refurbishment as preference to recycling.
- Moving from products to services – shifting from ownership to access. This allows higher utilisation of products across multiple users and can be facilitated through short-term rental, subscription, sharing or leasing rather than sale forever. It allows manufacturers to provide higher quality products and maximise the use of the resources in a cost-effective manner.
- Product life extension – design products that are both physically and emotionally durable or adaptive to a user's changing needs over time. Such products can be reused by a single user for a long-time or can be reused by many different users.

- Safe and circular material choices – avoid materials that are harmful to humans or the environment, including materials with high-embodied carbon which contributed to global warming.
- Dematerialisation – minimise the resource requirements required to deliver utility, for example through digitisation.
- Modularity and design for disassembly – to make buildings and products easy to disassemble, repair, remanufacture and upgrade. Modular systems are also easy to customise, adapting to a variety of users' needs and allowing for extended use.

Moving the economy from linear to circular will involve challenging and changing ingrained ways of thinking, investing and operating. Enabling mindsets and modes of working in a circular economy include systems thinking, lifecycle thinking, (re)design thinking, nature-based solutions, collaboration through distributive networks, activating change, and storytelling.

2.2 Importance of using recycled content in buildings and infrastructure

The built environment is a major contributor to climate change and resource consumption and the building and construction industry accounts for [39% of energy-related global carbon emissions](#) and approximately 50% of all materials consumed. In Australia the construction industry represents around [20% of Australia's](#) total emissions with around a quarter of all building emissions related to material production and construction.

2.2.1 Embodied Carbon

Building materials with lower embodied carbon generate less greenhouse gases during their production, transportation, maintenance over the life of the asset, and/or end of life. This can be achieved using renewable energy, reusable materials, and/or recycled materials. Materials with recycled content can be one of the most impactful ways to reduce embodied carbon emissions without compromising the quality, drastically changing the procurement process of those materials or exponentially increasing project costs.

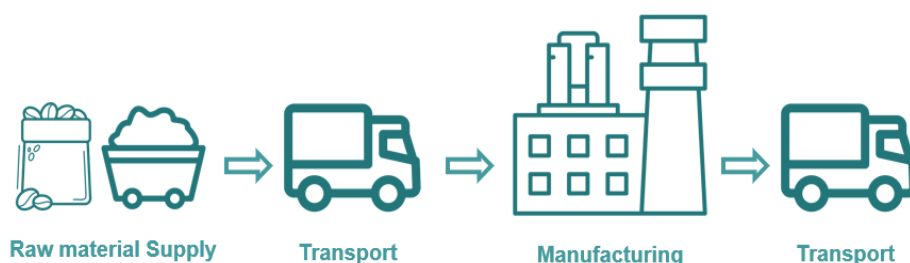


Figure 6 Lifecycle stages that contribute to the embodied carbon of products

All EAGA member councils have committed to reducing carbon emissions, they have identified that reducing embodied carbon emissions of building materials is key to achieving the carbon reduction targets and the aims of the Sustainability Victoria Recycled First policy.

By prioritising the selection of recycled and renewable building materials EAGA member councils are also:

- Incentivising the use of recycled materials by product manufacturers
- Showing leadership in the adoption of a circular economy
- Setting the standard for embodied carbon reduction at a council level
- Going beyond reducing scope 1 and scope 2 emissions
- Increasing the positive local environmental impact of circular economy initiatives
- Stimulating economic growth and opportunities

Although opportunities to reduce embodied carbon depend on various factors, including the type of project and location, the highest potential for reduction is generally at the start of a project as it

becomes more challenging to make design changes for embodied carbon reduction as the project progresses.

Careful consideration of future use and end-of-life during the design stage can help in further reducing the embodied carbon emissions and optimisation of the reuse of waste generated throughout the project, in later stages. Designing for disassembly to facilitate future reuse and selecting materials which can be easily separated for processing and recycling are some of the strategies that can be employed in the planning phases. Figure 7 below demonstrates some key end-of-life strategies to reduce embodied carbon via resource use in various life-cycle stages of a building or infrastructure project.

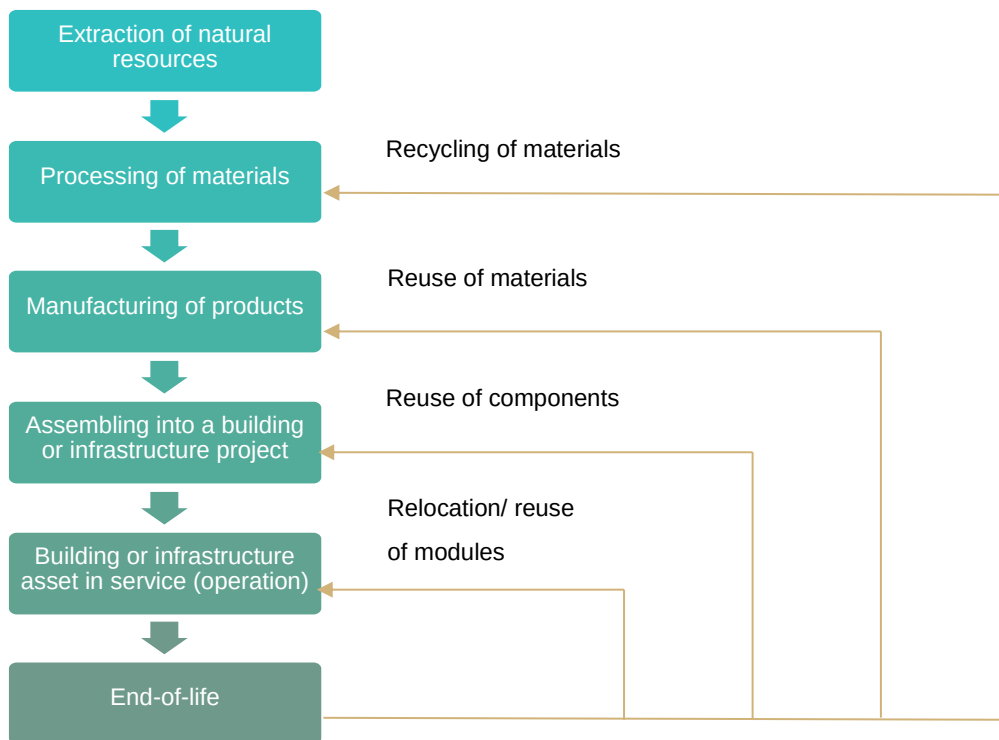


Figure 7 End-of-life strategies to reduce embodied carbon through resource use in various life-cycle stages of a building or infrastructure project.

3 Integrating Circular economy into Procurement

3.1 Establish key sustainability priorities

The procurement process is an important tool to achieve sustainable and circular outcomes. To integrate circular economy into procurement, participants should use a combination of strategy, policy, communicated targets and goals to set objectives and track ongoing progress.

By embedding this good practice approach to circular procurement, EAGA member councils will generate benefits to staff, economies and communities. EAGA member councils vary widely in their sustainability priorities, maturity, and resourcing, and therefore are at different stages in embedding circular economy into their procurement processes.

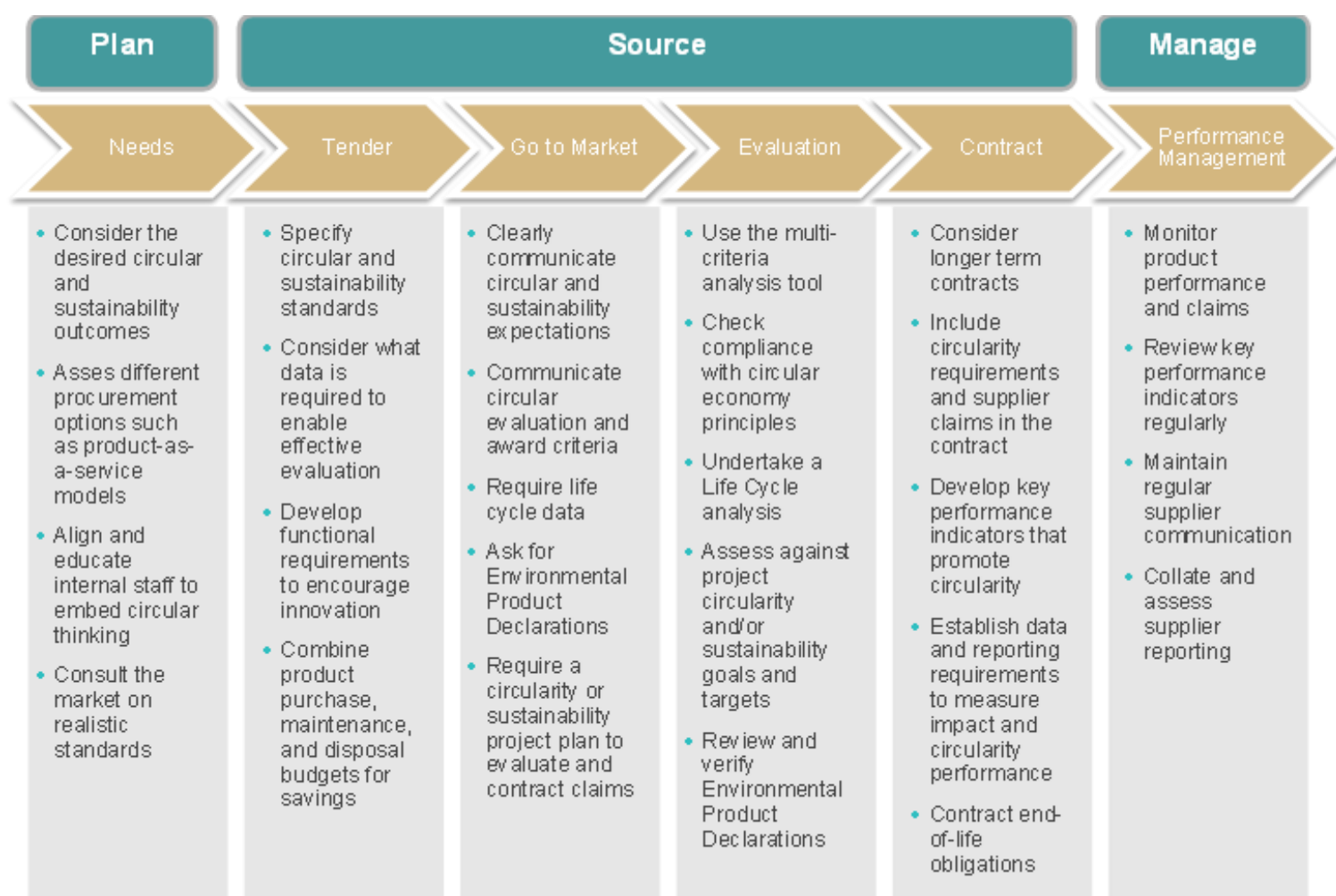


Figure 8 Circular considerations across the procurement lifecycle

It is not practical to ask suppliers about every aspect of sustainability; instead, at the start of each procurement activity, it is important for councils to identify the areas of high environmental risk or priority issues such as recycled content, local product origin or local job creation.

Sustainability issues can occur as hotspots throughout the life of the product or service, including in the supply chain, in the product itself, in the operations of the business or at a product's end of life.

An excellent good practice example of cornerstone circular procurement priorities and strategies by which to achieve them is included below in Figure 9 below.

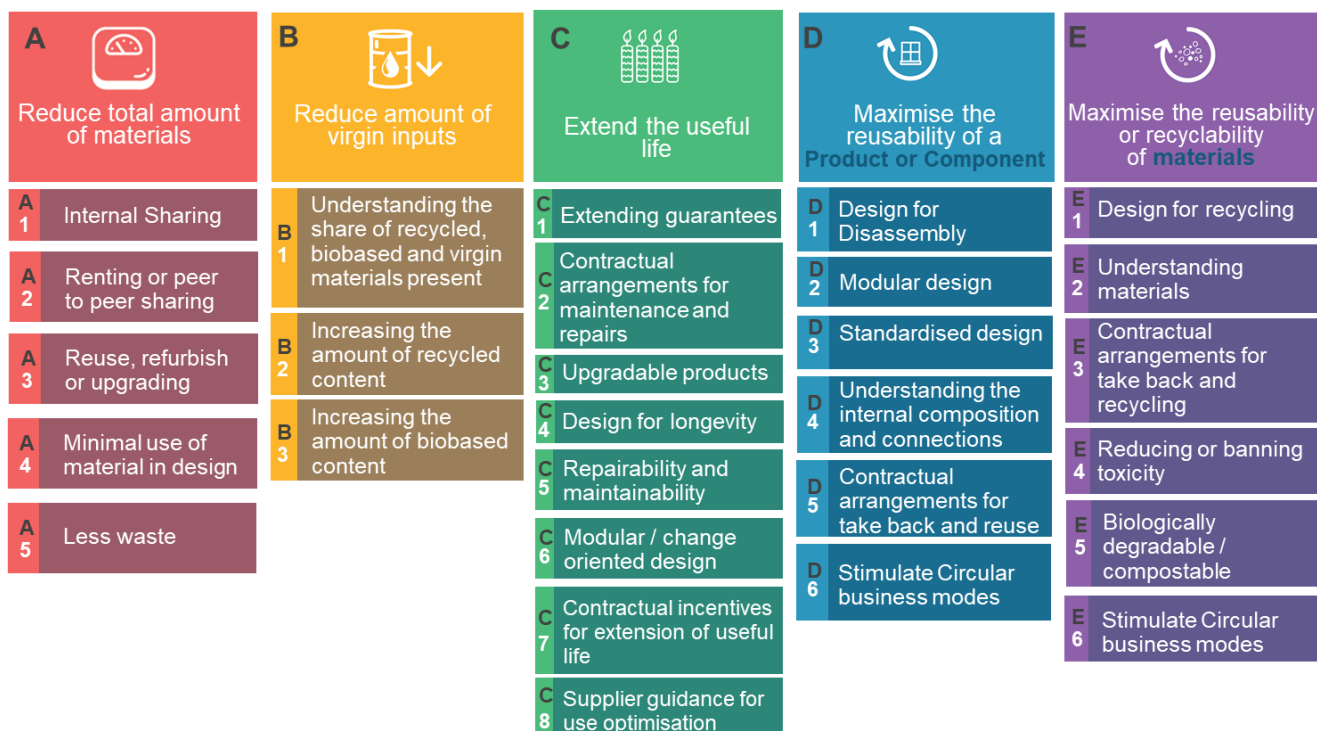


Figure 9 Circular Ambition Chart. Adapted from “Getting Started” by Circular Flanders, a website of the Flemish Government: <https://aankopen.vlaanderen-circulair.be/en/getting-started/the-ambition-map> © 2021 Aankopen Vlaanderen Circular

The key criteria included in EAGA Alternative Materials Multi Criteria Decision Analysis tool represents the priority considerations to achieve circular economy outcomes for the selected materials, in the context of the EAGA member councils and the Victorian Government Recycled First initiative. The criteria is not an exhaustive list, and the tool has been developed to be adapted and edited based on the specific project and procurement objectives as they arise.

3.1.1 Critical environmental, financial and social evaluation considerations

1. Environmental

- Carbon Footprint measured by embodied carbon (kgCo2 eq)
- Water Security measured by embodied water/ water impact (kL)
- Land Ecosystem measured by impact on the land ecosystem:
 - Native vegetation or habitat removal
 - Disturbance to habitats of endangered or threatened species
 - Potential to rehabilitate native areas
 - Potential for land contamination
 - Potential for erosion
- Circular economy measured by opportunities to reduce, reuse, recycle and avoid waste generation
 - Products that create a market for local waste streams
 - Seeking opportunities to participate in the circular economy.
- Recycled content measured by % of recycled content
- Climate resilience measured by direct impact on local community or surrounding environment - E.g. Urban heat island

2. Financial

- Lifecycle cost measured by net present value (NPV); the total cost of initial capital cost (unit cost, transportation and installation) and ongoing cost over the entire asset life (insurance, repair and maintenance and replacement).
- Reliability measured by assets reliability:
 - Fitness for purpose to meet the performance requirements

- c. Ease of implementation measured by skills, labour and/or technology required to implement
 - d. Availability measured by material market availability
 - e. Longevity measured by lifespan of product (number of replacements in construction lifespan 60 years)
- 3. Social**
- a. Safety measured by safety risks to employees, contractors, customers, community, or other internal/external
 - b. Compliance measured by legal compliance
 - c. Reconciliation (this criterion would be applied to the organisation not material) measured by:
 - o Trustworthy relationships and partnerships with Aboriginal communities
 - o Protect and integrate cultural heritage and knowledge
 - o Increased economic opportunities for Aboriginal businesses through supply chain
 - o Increased employment opportunities for Aboriginal people
 - d. Local Economy measured by job creation, local supplier spend
 - e. Innovation & Technology measured by innovation and technology in manufacture and technology
 - f. Engagement value measured by value to the local community
 - g. Supply chain human rights measured by risk of modern slavery practices in the supply chain

4 Highest Impact Materials

In 2016 the Infrastructure Sustainability Council of Australia (ISCA) launched the [Infrastructure Sustainability Rating Tool Materials Calculator](#) which provides the sum of emissions factor by kilogram of carbon equivalent by unit and product group (available at the time of publishing).

The table below provides an excellent summary of the advantages of different types of material containing various percentages of recycled content in reducing emissions in the building and infrastructure sector.

Table 1. CO₂- eq factors of building and infrastructure products

Material	kg CO2 eq
PTFE (teflon) film	341,097
ETFE film	341,097
Aluminium	19,993
Fibreglass Pipe & Tube	9,226
Glass fibre reinforced plastic (FRP)	9,226
PC sheet (e.g. danpalon)	8,438
Immersion Zinc coating	7,623
Polymer fibre reinforcement	4,800
LDPE film	4,352
Additives	4,253
InfraBuild Steel Centre, Hot rolled structural sections	3,720
Iplex APOLLOBLUE™ PVC-O pressure pipe	3,705
Iplex Premium PVC-U pressure pipe	3,588
Iplex PVC non-pressure pipe (solid and foam core)	3,523
Iplex RHINO® PVC-M pressure pipe	3,520
Steel rails - imported	3,486
PVC Pipes	3,459
Low relaxation strand and wire - imported	3,360
Liberty Primary Steel, Rail product	3,320
Liberty Primary Steel, Hot rolled structural sections	3,320
Steel, hot rolled powder coated - imported	3,209
Steel fibres for concrete reinforcement	3,200
Iplex BLACKMAX™ and SEWERMAX™ polypropylene pipe	3,155
Steel, hot rolled powder coated - Australian	3,056
HDPE film	3,034
PE Pipes	3,025
Steel, Hot rolled structural sections, imported	2,993
Iplex Polyethylene pipes	2,946
Steel pipe and tube - imported	2,935
Steel, welded beams and columns - imported	2,888

Steel, hot rolled metal coated - imported	2,887
Steel pipe and tube - Australian	2,795
BlueScope Welded Beams and Columns	2,750
Steel, hot rolled metal coated - Australian	2,750
Steel, plate - imported	2,667
BlueScope XLERPLATE® steel plate – Alloyed Steel	2,650
Paint - solvent based	2,552
BlueScope XLERPLATE® steel plate – Medium Carbon Steel	2,540
Paint - water based	2,521
uPVC sheet	2,515
Fibercon Emesh®	2,500
Steel, hot rolled coil - imported	2,499
BlueScope XLERPLATE® steel plate – Low Carbon Steel	2,490
BlueScope Hot Rolled Coil – Alloyed Steel	2,490
BlueScope Hot Rolled Coil – Medium Carbon Steel	2,380
BlueScope Hot Rolled Coil – Low Carbon Steel	2,330
Reinforcement steel mesh - imported	2,163
ARC, Reinforcing Mesh	2,060
InfraBuild Construction Solutions, Reinforcing Mesh	2,060
InfraBuild Steel, Reinforcing Rod and Wire	1,980
InfraBuild Steel, Low relaxation wire	1,980
Reinforcement steel bars - imported	1,754
ARC, Reinforcing Bar	1,670
InfraBuild Construction Solutions, Reinforcing Bar	1,670
InfraBuild Steel, Reinforcing Bar	1,580
Ductile Iron Pipes	1,542
InfraBuild Steel Centre, Merchant bar product	1,520
Steel, merchant bar - imported	1,449
InfraBuild Steel, Merchant bar product	1,240
Cement Fibreboard	1,211
Alkali activator	1,099
Rubberised Bitumen	985
Flat Glass	982
Cement	974
Portland Cement	974
Lime (hydraulic)	875
MDF (Medium Density Fibreboard)	729
Particleboard	641
Polymer Modified Bitumen (PMB)	559
Plywood	544

CLT (Cross-Laminated Timber)	447
Bitumen	384
Foam bitumen (3% water)	373
Humes RCP, Dry-cast pipes, NSW, Class 4	341
Humes RCP, Dry-cast pipes, NSW, Class 3	334
Reinforced Concrete Pipes	322
Humes RCP, Dry-cast pipes, NSW, Class 2	297
Humes RCP, Spun pipes, NSW/VIC/SA/WA/TAS, Class 4	292
Humes RCP, Spun pipes, NSW/VIC/SA/WA/TAS, Class 3	285
Humes RCP, Spun pipes, NSW/VIC/SA/WA/TAS, Class 2	271
Humes RCP, Spun pipes, QLD/NT, Class 4	259
Humes RCP, Spun pipes, QLD/NT, Class 3	240
Humes RCP, Dry-cast pipes, QLD, Class 4	237
Timber, Structural (hardwood)	229
Humes RCP, Spun pipes, QLD/NT, Class 2	228
Humes RCP, Dry-cast pipes, QLD, Class 3	216
Humes RCP, Dry-cast pipes, QLD, Class 2	196
GGBF slag	177
Timber, Structural (softwood)	156
Geopolymer pipes	147
Downer Reconophalt AC10 C320 R10	65
Hot mix asphalt, standard mix, 5.5% virgin bitumen (0% RAP)	61
Hot mix asphalt, 5.25% virgin bitumen (5% RAP)	59
Hot mix asphalt, 5% virgin bitumen (10% RAP)	58
Warm mix asphalt, standard mix, 5.5% virgin bitumen (0% RAP)	56
Hot mix asphalt, 4.75% virgin bitumen (15% RAP)	56
Downer Reconophalt AC10 C320 R30	55
Warm mix asphalt, 5.25% virgin bitumen (5% RAP)	55
Hot mix asphalt, 4.5% virgin bitumen (20% RAP)	54
Warm mix asphalt, 5% virgin bitumen (10% RAP)	53
Hot mix asphalt, 4.25% virgin bitumen (25% RAP)	53
Warm mix asphalt, 4.75% virgin bitumen (15% RAP)	51
Hot mix asphalt, 4% virgin bitumen (30% RAP)	51
Warm mix asphalt, 4.5% virgin bitumen (20% RAP)	50
Hot mix asphalt, 3.75% virgin bitumen (35% RAP)	49
Warm mix asphalt, 4.25% virgin bitumen (25% RAP)	48
Hot mix asphalt, 3.5% virgin bitumen (40% RAP)	48
Warm mix asphalt, 4% virgin bitumen (30% RAP)	46
Downer Reconophalt AC14 C170 R50	46
Warm mix asphalt, 3.75% virgin bitumen (35% RAP)	45

Hot mix asphalt, 2.5-3.4% virgin bitumen (40-60% RAP)	44
Warm mix asphalt, 3.5% virgin bitumen (40% RAP)	43
Warm mix asphalt, 2.5-3.4% virgin bitumen (40-60% RAP)	40
Hot mix asphalt, <2.5% virgin bitumen (>60% RAP)	38
Warm mix asphalt, <2.5% virgin bitumen (>60% RAP)	33
Steel Galvanised Coil - Steel BMT (per mm) only	19
Crushed Blast Furnace Slag	18
Flyash	14
BlueScope Steel Colorbond® AM100, 0.48mm BMT	13
BlueScope Steel Colorbond® AM100, 0.42mm BMT	11
Crushed Rock	10
Ballast	10
Coarse Aggregates	10
Manufactured sand	7
Recycled Aggregates	7
Concrete production process	7
Recycled Crushed Glass	5
Gravel	5
Fine Aggregates	4
Sand	4
Recycled Crushed Concrete/Masonry	4
Crushed Limestone	2

4.1 Council top 20 materials

Following analysis of the data, documentation and interviews provided in the first project phase, Edge created a long list of potential categories and materials to conduct a detailed opportunities analysis and alternate materials research. After undertaking desktop research, the short list of materials and alternatives and the associated criteria, were presented in a workshop in March 2022, to validate findings and confirm inclusions.

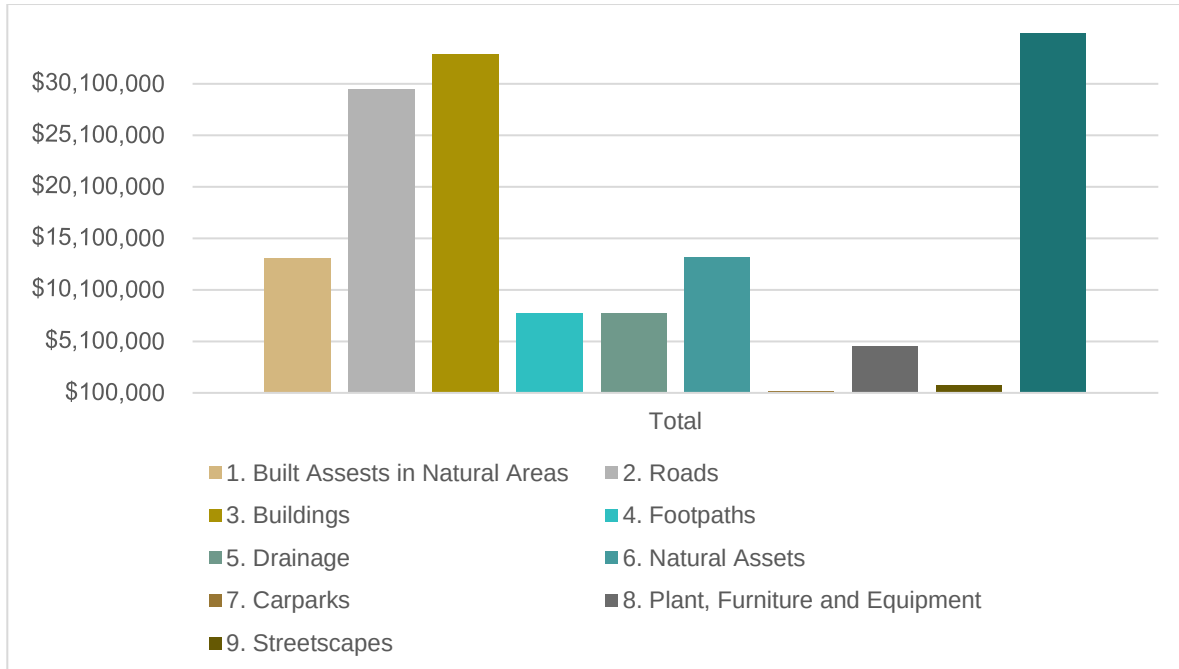


Figure 10 Total annual spend by category across EAGA councils

The criteria for material selection included:

- **Times mentioned:** If a material was mentioned by more than one council during the interview phase it was considered.
- **Annual spend:** We selected materials from the categories with the highest per annum spend on average by council (where information was available).
- **Environmental impact:** Consideration to lifecycle and environmental impacts as most materials present a high carbon intensity. The greater the volume, the higher the positive and negative impacts.
- **Recycled content:** Materials with recycled content and local market availability for practical implementation opportunities.
- **Possibility of influence:** By selecting materials with a high annual volume councils can leverage their purchasing power to influence the market for higher recycled content and circular economy outcomes.
- **Design norms:** Materials are a common requirement used in average building and construction.
- **Availability and community impacts:** There are alternative materials available in the Australian market.
- **Fit for purpose:** Alternative materials are supported by performance evidence.
- Complementary to the Recycled First project being undertaken in parallel.

Figure 11 below represents the data sources to determine the commonly used categories and materials.

Category	Material	Description	Number of Councils	Source (Interviews, Documents, both)
Buildings	Drainage pipes	For road construction and maintenance.	7-8	Both
	Plasterboard	For building construction	4-6	Interviews
	Carpet	For building construction	1-3	Interviews
	Tiles	For building construction	1-3	Interviews
	Sand	For building construction and roads	1-3	Interviews
	Metal Roofing	For building construction	1-3	Interviews
	Vinyl Flooring	For building construction	1-3	Interviews
	Brickwork	For buildings, walls, and property lines.	4-6	Interviews
	Steel	For building construction	4-6	Interviews
	Insulation materials	For building construction.	1-3	Interviews
	Paint	For buildings, fences and railing.	1-3	Interviews
	Metal Cladding	For building facades	4-6	Interviews
	Electrical cabling and conduits	For building constructions	1-3	Interviews
	Decking materials	For public areas and buildings	1-3	Interviews
Roads	Asphalt	Used in new roads and in road maintenance and resurfacing	7-8	Both
	Crushed Rock	Used as a base in both sealed and unsealed roads	7-8	Both
	Concrete	Used in building constructions and footpaths	7-8	Both
	Sand	For building construction and roads	1-3	Interviews
Natural Assets	Concrete	Used in building constructions and footpaths	7-8	Both
	Crushed Rock	Used as a base in both sealed and unsealed roads	7-8	Both
	Gravel	Used in new paths, roads and in maintenance and resurfacing	7-8	Both
Built Assets in Natural Areas	Park furniture	For public areas	4-6	Both
	Concrete	Used in building constructions and footpaths	7-8	Both
	Crushed Rock	Used as a base in both sealed and unsealed roads	7-8	Both
	Asphalt	Used in new roads and in road maintenance and resurfacing	7-8	Both
	Sand	For building construction and roads	1-3	Interviews
	Brickwork	For buildings, walls, and property lines.	4-6	Interviews
	Fibre reinforced plastic	For gutter bridges at raised pedestrian crossings	1-3	Interviews
	Timber	For building construction and parks	1-3	Interviews
	Decking materials	For public areas and buildings	1-3	Interviews

Category	Material	Description	Number of Councils	Source (Interviews, Documents, both)
	Railing	For public areas and fences	1-3	Interviews
Footpaths	Concrete	Used in building constructions and footpaths	7-8	Both
	Crushed Rock	Used as a base in both sealed and unsealed roads	7-8	Both
	Asphalt	Used in new roads and in road maintenance and resurfacing	7-8	Both
	Footpath Materials	For road and public spaces	4-6	Both
	Fibre reinforced plastic	For gutter bridges at raised pedestrian crossings	1-3	Interviews
Drainage	Sand	For building construction, roads and drainage	1-3	Interviews
	Concrete	Used in building constructions and footpaths	7-8	Both
	Crushed Rock	Used as a base in both sealed and unsealed roads	7-8	Both
	Asphalt	Used in new roads and in road maintenance and resurfacing	7-8	Both
Plant, Furniture and Equipment	Concrete	Used in building constructions and footpaths	7-8	Both
	Crushed Rock	Used as a base in both sealed and unsealed roads	7-8	Both
	Asphalt	Used in new roads and in road maintenance and resurfacing	7-8	Both
	Sand	For building construction and roads	1-3	Interviews
	Brickwork	For buildings, walls, and property lines.	4-6	Interviews
	Fibre reinforced plastic	For gutter bridges at raised pedestrian crossings	1-3	Interviews
Carparks and Streetscapes	Concrete	Used in building constructions and footpaths	7-8	Both
	Crushed Rock	Used as a base in both sealed and unsealed roads	7-8	Both
	Asphalt	Used in new roads and in road maintenance and resurfacing	7-8	Both

Figure 11 Common Council materials

4.2 Councils Highest Impact Materials

The outcome of the prioritisation process, agreed by the EAGA project team, identified the five highest impact materials:

1. Asphalt
2. Concrete
3. Natural aggregates
4. Brickwork
5. Steel

These findings are supported by Edge research, published in the [Australian buildings and infrastructure: Opportunities for cutting embodied carbon industry report](#) 2021. Data from eight road projects across five states NSW, VIC, WA, SA, and QLD were analysed. It was found that five materials: asphalt, concrete, steel, aggregates and pipes (including concrete pipes); accounted for ~97% of embodied carbon, with asphalt and concrete being the most significant contributors (see Figure 12 below).

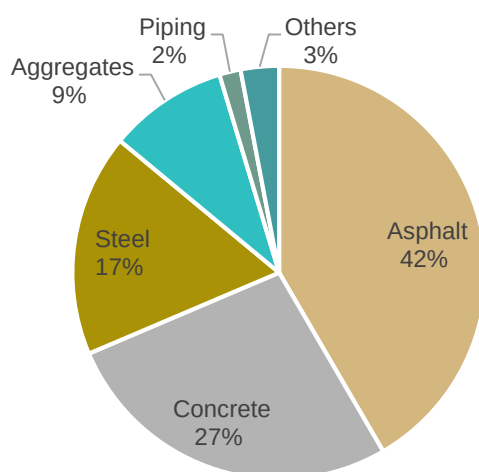


Figure 12 – Embodied emissions contribution of materials for road projects (Actual Case – As-Built data for roads)

The project research estimates a 23% reduction in embodied carbon emissions through changes in material types.

#	Materials	Change: Actual vs Base case		Total embodied carbon (t CO ₂ eq.)	
		(tCO ₂ eq.)	Percentage	Base case	Actual case
1	Asphalt	-231,318	-29%	1,620,154	1,245,777
2	Concrete	-143,448	-30%		
3	Steel	-5,674	-3%		
4	Aggregates	4,362	6%		
5	Piping	3,362	18%		
6	Others	-1,208	-4%		
7	Total	-374,376	-23%		

Figure 13 Embodied carbon reduction in road projects

Figure 14 and Figure 15 depict the embodied carbon reduction potential of design and materials initiatives in an industrial building project with a Gross Floor Area (GFA) of ~74,500 m².

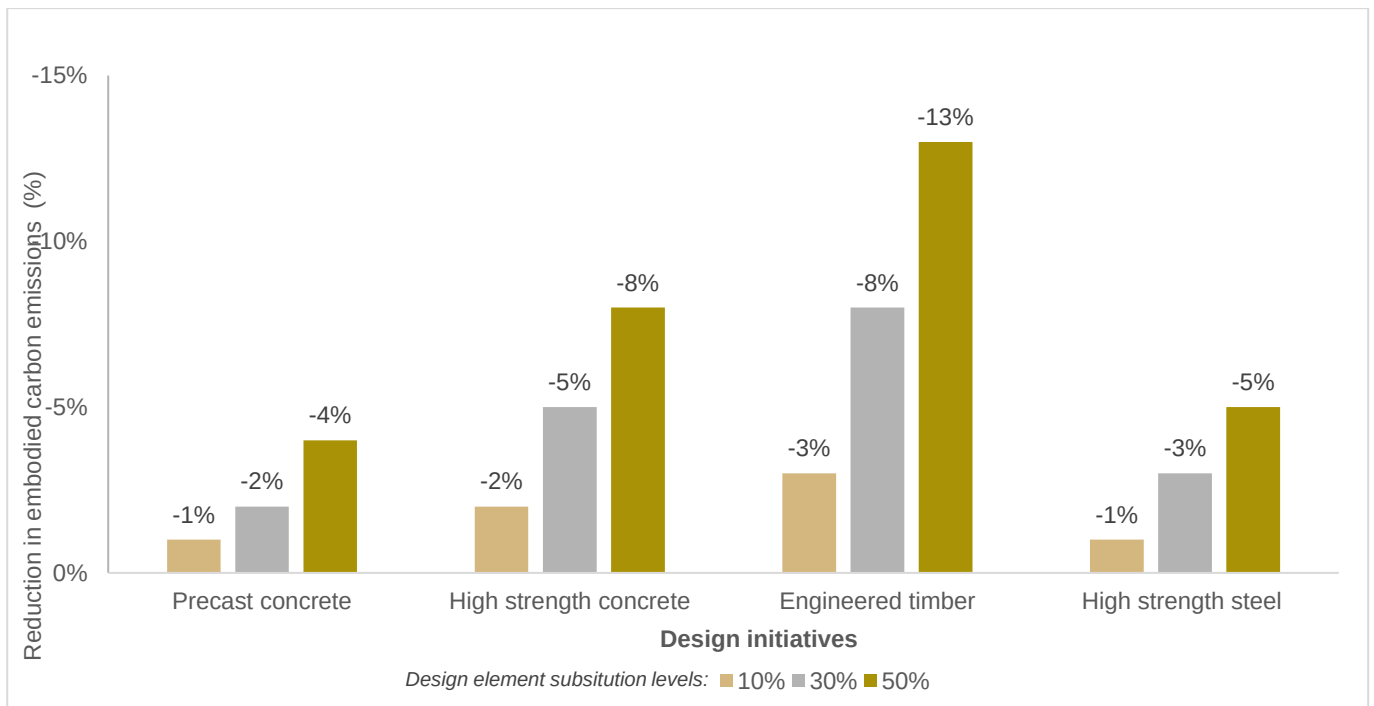


Figure 14 Embodied carbon reduction due to design initiatives in an industrial building project

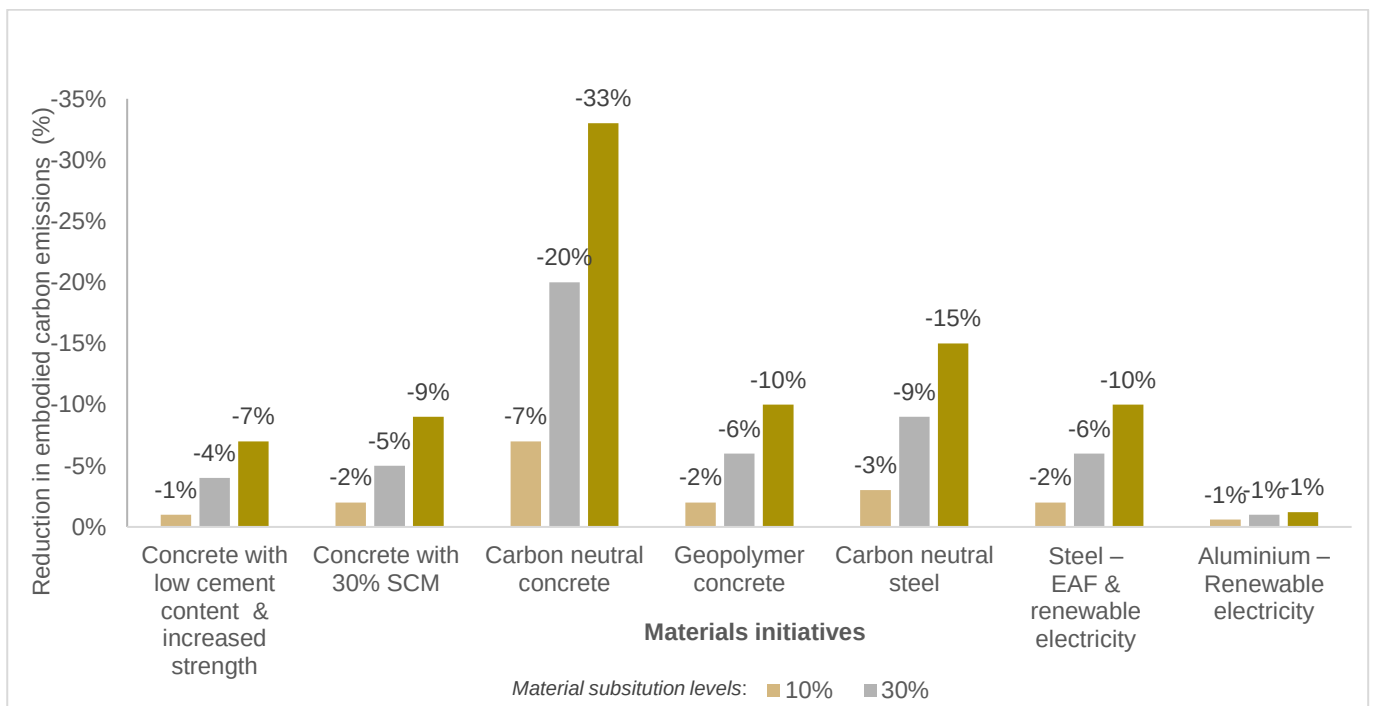


Figure 15 Embodied carbon reduction due to materials initiatives in an industrial building project

4.3 Asphalt

Asphalt is the most reused construction material in the world (AAPA, 2018). It is potentially 100% recyclable, depending on factors such as the quality and age of the asphalt pavement. Asphalt pavements are typically composed of around 5% bitumen and 95% aggregate. The primary use of asphalt is the construction of the road and footpaths, asphalt mixes are also used in the repair and maintenance of those structures.

Asphalt is one of the highest impact materials by annual spend across EAGA member councils individually and collectively, with a huge opportunity for recyclability.

For more information on asphalt, reclaimed asphalt pavement (RAP), crumb rubber modified asphalt (CRMA), Victorian standards and specifications and Victorian based recycled content suppliers please refer to the [Buy Recycled materials and supplier directory](#).

To conduct an evaluation of lifecycle costings of asphalt, recycled and reused alternate materials against established criteria please refer to the Asphalt tab in the accompanying EAGA Alternative Materials Multi Criteria Decision Analysis tool.

4.3.1 Reclaimed Asphalt Pavement (RAP)

Asphalt can be recycled and reused in new pavements and is generally recovered from maintenance rehabilitation of existing roads. Reclaimed Asphalt Pavement (RAP) has similar or better performance than virgin asphalt, it is widely available in Australia and can be complemented with other waste products to improve performance such as: soft plastics, recycled glass fines, and toner.

Advantages

- Similar performance
- Lower emissions
- Recycled content
- Reductions in quarried aggregates, reducing project-level embodied carbon
- Can be reused at end of life
- Initial higher markets costs will be reduced overtime as it becomes more widely used

Disadvantages

- RAP content over 40% can only be used in low traffic conditions
- Potential supply issues as demand increases against a backdrop of decreasing stocks
- Arduous approvals process for high RAP mixes, limited opportunity for innovation

4.3.2 Crumb Rubber Modified Asphalt (CRMA)

Australia generates the equivalent of 56 million used car tyres every year. Around 30% of those end up in landfill. Asphalt made using crumb rubber from old tyres has similar or improved performance to virgin asphalt and is a great way of diverting waste from land fill.

Asphalt made using crumb rubber from old tyres has already been trialled in East Boundary Road, Melbourne as part of a major new trial involving the Australian Road Research Board, Victorian Department of Transport, industry partners and the Australian Flexible Pavement Association (AfPA), with funding from the Tyre Stewardship Australia (TSA).

Advantages

- Tyres are a significant waste product, supply is readily available
- Applicability in Type H wearing course and potentially other layers in lower amounts
- Increased performance
- Can be used at a reduced thickness
- Increased durability
- Quieter roads

- Safer
- Less maintenance cost
- Longer use life
- Initial cost will be reduced overtime as it becomes more widely used

Disadvantages

- Higher initial cost due to fewer suppliers
- Requires specialist knowledge in construction (in colder conditions)

4.4 Structural Concrete

Concrete is widely used in building construction as structural support as well as in infrastructure construction such as roads, bridges, and footpaths. So widely that cement is one of the two most significant sources of embodied carbon emissions in construction with cement manufacturing accounting for 7% of global carbon emissions (World Green Building Council, 2019).

Conventional concrete is a high contributor to CO2 emissions and was a high use and high spend material across EAGA member councils.

For more information on concrete, mass timber, geopolymers concrete, Victorian standards and specifications and Victorian based recycled content suppliers please refer to the [Buy Recycled materials and supplier directory](#).

To conduct an evaluation of lifecycle costings of concrete, recycled and reused alternate materials against established criteria please refer to the Concrete tab in the accompanying EAGA Alternative Materials Multi Criteria Decision Analysis tool.

4.4.1 Mass Timber

Mass timber reduces high environmental impacts from concrete, especially embodied energy consumption and associated CO2 emissions, while reducing the use of non-renewable resources.

Advantages

- Construction speed
- Reductions in cement volumes, reducing embodied carbon
- Low environmental impacts
- Lightweight
- Cost saving
- Reduced on-site labour
- Carbon sequestration
- Future proofing and reduced cost to council & community in future

Disadvantages

- Few suppliers
- Lack of design standards
- Industry lack of knowledge
- Higher insurance costs

4.4.2 Geopolymer Concrete

Low carbon concrete or geopolymer concrete uses supplementary cementitious materials (SCMs) such as ground granulated blast furnace slag (GGBFS) or fly ash to replace high CO2 intensive traditional cement. GGBFS is a by-product of steel production and fly ash is the waste of thermal power plants, therefore, they are much lower CO2 contributors.

Geopolymer concrete uses waste from the steel and coal industries by combining aluminosilicate by-products (precursors), alkali activator, aggregate and water to produce a low embodied carbon

product. Geopolymer concrete production reportedly generates 300 kg of CO₂ per tonne of cement, compared to 900kg of CO₂ per tonne from traditional methods.

The City of Sydney in collaboration with the University of New South Wales and the Australian Iron and Steel Association has trialled the use of a blend of low carbon concrete and recycled materials on roads. The trial site is located on a public road in the City of Sydney and will be assessed against a control of traditional cement road. The geopolymer concrete is being tested to assess the durability of the product. The data gathered from this trial will be used to create new industry guidelines for using geopolymer concrete blends as pavement. Monitoring of the trial began in 2019 and will continue for five years.

Advantages

- Improved durability
- Reduction in embodied emissions compared to traditional Portland cement concrete
- The inclusion of alkali activated binders reduces the need for kiln processing and therefore greatly reduces greenhouse gas emissions associated with cement production
- Utilises waste from steel production and thermal power plant

Disadvantages

- Limited local suppliers

4.5 Aggregates

Aggregates provide the foundation for roads, bridges, and buildings, while also being a high percentage of asphalt pavement and concrete mixes.

Crushed rock and gravel are critical components in many infrastructure projects and were also named by every EAGA council member as a priority material. Recycled content in aggregates is derived from a wide variety of materials; aggregate, brick, glass, paper, plastic, geosynthetics, soil, steel and rubber in addition to concrete and asphalt.

For more information on natural aggregates, recycled and manufactured aggregates, Victorian standards and specifications and Victorian based recycled content suppliers please refer to the [Buy Recycled materials and supplier directory](#).

To conduct an evaluation of lifecycle costings of aggregates, recycled and reused alternate materials against established criteria please refer to the Aggregates tab in the accompanying EAGA Alternative Materials Multi Criteria Decision Analysis tool.

4.5.1 Recycled Aggregate

Construction waste and demolition waste such as concrete or brick can be crushed and reused as road base or non-structural applications and helps get those products out of landfill.

Advantages

- Creates circular economy
- Less waste to landfill
- Multiple applications
- Widely available

Disadvantages

- Higher energy consumption than virgin materials
- Risks associated with present high demand for recycled aggregate in Victoria

4.5.2 Manufactured Aggregates from By-Products

Manufactured aggregates are the by-products of quarrying operations. Using manufactured aggregates is a way of diverting waste from landfill.

Advantages

- Circular economy of mine waste
- Can be part of a remediation process

Disadvantages

- Higher energy consumption than virgin materials
- Limiting the replacement level to 20% or 30% of the coarse aggregate to ensure a negligible impact on workability, compressive strength, durability and deformation

4.6 Brickwork

Brickwork can be used for structural or cladding purposes in buildings. Bricks have a capability for local production and low transport; however, they are energy dense and utilised in construction and paths by most councils.

For more information on brickwork, mass timber and carbon neutral bricks, Victorian standards and specifications and Victorian based recycled content suppliers please refer to the [Buy Recycled materials and supplier directory](#).

To conduct an evaluation of lifecycle costings of brickworks, recycled and reused alternate materials against established criteria please refer to the Aggregates tab in the accompanying EAGA Alternative Materials Multi Criteria Decision Analysis tool.

4.6.1 Mass Timber

Mass timber is solid enough to be used as an alternative structural material in low-rise to mid-rise buildings and potentially in high-rise buildings.

Advantages

- Construction speed
- Low environmental impacts
- Lightweight
- Cost saving
- Reduced on-site labour
- Carbon sequestration
- future proofing and reduced cost to Council & Community in future

Disadvantages

- Few suppliers
- Lack of design standards
- Industry lack of knowledge
- Higher insurance costs

4.6.2 Carbon Neutral Bricks

Carbon Neutral Bricks can be locally produced and foster local communities, despite not being the latest in technology they are available to councils in Victoria and have a lower carbon footprint.

Advantages

- Produced in Australia
- Same quality as normal bricks
- Lower CO2 Emissions

Disadvantages

- More expensive
- Fewer suppliers

4.7 Steel

Steel has diverse uses in construction, one of its biggest uses is as a structural material. The Australia Government's first Low Emissions Technology Statement under the Technology Investment roadmap identified low carbon materials (steel and aluminium) as priority low emissions technologies that have high abatement and economic potential in areas of comparative advantage for Australia (Australian Government, 2020).

There is no doubt that steel has been a foundation material in infrastructure and has high council use, however it remains carbon intensive and there are challenges in the sustainability of the supply chain.

For more information on steel, mass timber and low carbon steel, Victorian standards and specifications and Victorian based recycled content suppliers please refer to the [Buy Recycled materials and supplier directory](#).

To conduct an evaluation of lifecycle costings of steel, recycled and reused alternate materials against established criteria please refer to the Aggregates tab in the accompanying EAGA Alternative Materials Multi Criteria Decision Analysis tool.

4.7.1 Mass Timber

Mass timber reduces high environmental impacts from steel, especially embodied energy consumption and associated CO2 emissions. While reducing the use of non-renewable resources.

Advantages

- Construction speed
- Low environmental impacts
- Lightweight
- Cost saving
- Reduced on-site labour
- Carbon sequestration

Disadvantages

- Few suppliers
- Lack of design standards
- Industry lack of knowledge
- Higher insurance costs

4.7.2 Low Carbon Steel

Low-carbon steel contains up to 0.05% - 0.30% carbon by weight. Its reduced carbon content makes it more malleable and ductile than other steel types. It can be used for some structural shapes (I-beams, channel and angle iron), pipes, construction and bridge components, etc.

Advantages

- Lower cost
- Workability (malleability)
- Lower amount of carbon

Disadvantages

- Low tensile strength and cannot be used in all applications

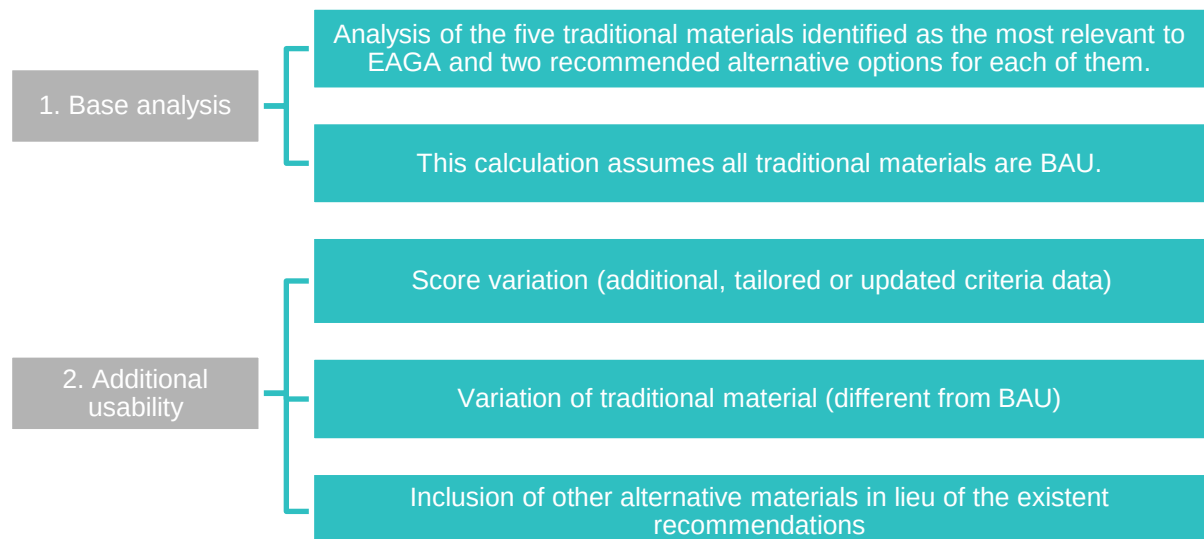
5 EAGA Alternative Materials Multi Criteria Decision Analysis tool

The tool provides a Multi Criteria Decision Analysis (MCDA) capability based on a Triple Bottom Line (TBL) approach to support stakeholders involved in the local government procurement process to evaluate alternative options for the five traditional construction materials identified as the most relevant to EAGA councils and aid in the decision making for more sustainable outcomes.

Materials are assessed on 18 social, environmental and financial criteria (see section 12) and scoring for each criterion is assigned based on the performance of the proposed materials relative to the performance of the Business as Usual (BAU) traditional materials. The BAU performance is specified in the tool for each traditional material included.

5.1 Usability

This tool provides two functions: 1. base analysis and 2. additional usability.



5.1.1 Base analysis

The base analysis follows the scope of the project and includes the assessment of the 5 traditional materials identified as the most relevant to EAGA against the two recommended alternative options for each of them. This analysis assumes that all traditional materials are BAU.

5.1.2 Additional usability

The additional usability of the tool allows the functionality and applicability to remain current and versatile when assessing materials by providing the option to make additional changes in the materials and scoring. Specifically, it allows the user to:

- Change the score of the alternative materials in the case further, tailored or updated data is gathered by changing the performance in the 'Criteria score tab'
- Use a variation of the traditional material by changing the name in column C in the 'Materials' tab and the score in the 'Criteria score' tab, relative to the outcome of the BAU traditional material.

- Include other alternative materials in lieu of the existing recommendations by modifying the 'Materials tab' and the scores in the 'Criteria score' tab.

5.1.3 Scope

The use of the MCDA tool enables robust sustainable outcomes through the procurement process by providing a different approach to current practices. Integrating criteria included in the tool in procurement tender documentation will ensure the appropriate information that procurement and technical teams require for informed decision making is both sourced and assessed. The use of the tool is recommended whenever possible, however, it may not be appropriate for every project, as it requires specific input data.

The tool is recommended to be implemented for projects that include one or more of the high impact materials mentioned in this report and included in the base analysis where the default alternative options are feasible or slightly different, as this calculation would only require life cycle costing data and possible minor updates in the scoring.

In addition, the implementation of the tool is recommended for high risk projects or projects with assets with a long life even if the traditional materials or its alternatives are not part of the base analysis, as it will facilitate a social, environmental and life cycle financial assessment to quantify value for money in a meaningful way.

5.1.4 Limitations

The materials included in the scope of this report and analysis come in diverse mixes and designs, council technical leads will want to compare products that have similar technical properties to achieve the desired performance. There is a level of complexity below the generic product type that the tool is unable to provide without detailed lifecycle costing data and further information.

- The multi criteria decision tool is the first step to provide an analysis of hot spots and inform the priority focus areas to conduct a more detailed business case.
- Variable attributes based on different designs include the carbon footprint, water use, and % recycled content.
- The per unit cost will vary based on the supply availability, project location, type of mix design (e.g. 50Mpa concrete vs 30 Mpa concrete).

6 Sustainability and Circular Economy Criteria Examples

This Report provides examples of criteria, specifications and clauses that can be included in procurement documents such as scoping documents, expression of interest, request for quotation or tenders.

6.1 Non-technical sustainability criteria

Inclusion of non-technical sustainability requirements and evaluation criteria should be proportional to the risk and value of the procurement and specific to the sustainability and circular economy targets and ambitions of the project.

A supplier may not have non-technical policies, procedures, statements and systems that are not required by law; a small medium enterprise may not have a modern slavery or carbon emissions reduction policy in place for example. Non-technical criteria documentation is not an automatic pass or fail, the outcome is an evidenced-based assessment of risks, strengths and weaknesses which identifies the focus areas for improvement relevant to the procurement activity and sustainability priorities. Actions to address improvement focus areas can include:

- Contract clauses to specifically address identified improvement areas,
- Agreed improvement plan on actions to be undertaken over a specific time which is included in the contract and/or project obligations and an important element of a supplier capacity building/relationship management approach. If the actions are not taken in the timeframe, there are grounds to formally issue notice and/or terminate the agreement, and
- For risks that are not material, entry into the risk register and monitoring over the term of the relationship.

What should be included?	Means of evaluation
Carbon and emissions reduction	
Does your organisation have a formalised environmental policy in relation to energy consumption and GHGs (e.g., management/reduction of energy and fuel consumption, CO ₂ emissions)?	• Copies of policies or reports.
Does your company track energy consumption (including purchased electricity)? Does your organisation calculate its emissions? If yes, please provide metrics, for example: Organisational scope 1, 2 or 3 emissions or emissions per \$ revenue.	• Copies of reporting.
Does your organisation calculate product emissions? If so, please provide metrics.	• Copies of reporting or evidence of calculations, Product Environmental

What should be included?	Means of evaluation
	Footprints (PEFs) or Environmental Product Declarations (EPDs).
Generic product information	
How does the product demonstrate circular economy principles (where the source and type of materials, the manufacturing and distribution are all designed to keep materials in use and design out waste and pollution)?	Evidence provided, verified independently or published externally.
Does the product contain recycled content sourced from Australia (recycled feedstock is generated from Australia, and state if it is pre- or post-consumer recycled content? If yes, please provide details.	%, type of recycled content and the location it is sourced from.
Is the product made from virgin inputs? If yes, are there inputs from renewable feedstocks, where proven to be environmentally beneficial, and, where relevant, are sourced from regenerative sources?	Evidence provided, verified independently or published externally.
Is the product manufactured, distributed, sorted and/or recycled using renewable energy?	Evidence provided, verified independently or published externally.
Does the production process maximise resource efficiency (water, energy, material use etc.)?	Evidence provided, verified independently or published externally.
Product lifespan	
Is your product designed and manufactured to be durable, repaired or refurbished to extend your product's lifespan? (e.g. ease of finding spare parts, access to tools required to replace components, able to be repaired or refurbished safely)	Evidence provided, verified independently or published externally.
Does your business model enable extending your product's lifespan (e.g. your organisation and/or network can provide maintenance, repair, reuse, rental or subscription model, or refurbishment options at scale)?	Evidence provided, verified independently or published externally.
How high is the potential for your product to be recycled after use? e.g. does technology exist to recycle your product or the materials comprising your product? Can materials comprising your product	• High • Medium

What should be included?	Means of evaluation
be dismantled easily? Are there recycling services readily available in Australia to recycle these materials? Please provide evidence.	Low
Do you provide a system to collect or receive your product for reuse, repurpose, refurbishment, remanufacturing or recycling? Please detail any costs associated with supplying this service.	Evidence provided, verified independently or published externally.
Packaging design and end-of-use management	
Is the product packaging made from any reusable, recyclable or compostable materials?	% and type of content.
Does the product packaging include materials, components or formats that: a) Are not reusable, recyclable or compostable? b) Can be avoided altogether? c) Hinder or disrupt recycling? d) Have a high likelihood of being littered? or e) Contain hazardous chemicals?	Evidence provided, verified independently or published externally.
Can single-use packaging be replaced with reusable formats, i.e., refillable or returnable, or an alternative delivery model?	Evidence provided, verified independently or published externally.
Is the product packaging or plastic 100% recyclable or compostable, meaning can they be effectively recycled or composted in practice and at scale?	% and type of content.
Are you currently engaging with suppliers on waste and doing due diligence on their packaging?	Documented evidence of engagement or supplier contacts.
Do you have formal targets to reduce packaging?	Documented evidence.
Modern slavery	

What should be included?	Means of evaluation
Has your organisation assessed the risks relating to modern slavery in its operations and supply chains? These risks may relate to geography, labour, services, resources or materials. Please provide evidence.	Evidence of understanding of risk. If large organisation (revenue over \$100mil) supplier to demonstrate knowledge of operational and supply chain risks of modern slavery in a Modern Slavery Statement (as per <i>Modern Slavery Act 2018</i>). Smaller organisations may not have published a Statement and have less governance in place (depending on sector)
Do employees of your organisation have the right to join or form trade unions of their own choosing, and to bargain collectively, without prior authorisation from your management according to national law?	Yes/No response. Requires evidence of third-party audits, sharing copies can be included in contract on an annual/bi-annual basis.
What percentage of your workforce would be classified as migrant labour?	This question provides indication of risk, governance and knowledge of labour workforce.
Does your organisation provide every worker at all sites and facilities with written information about their employment conditions, including wages, hours and holidays, before they enter into employment?	Yes/No response. Requires evidence of third-party audits, sharing copies can be included in contract on an annual/bi-annual basis.
Does your organisation outsource some or all of your recruitment and labour hire?	Low risk if: • Supplier directly recruits, selects and hires all workers (full time, part time, temporary and seasonal) and • Contracts of employment in place with all workers and copies of the

What should be included?	Means of evaluation
	workers' contracts are readily available. • Or supplier monitors third-party labour providers or subcontractors and ask them to provide evidence of no recruitment fees.
What degree of visibility or control do you have over your suppliers' sub-contractors or third-party organisations?	This question provides indication of risk. • High visibility: evidence of signed contracts, verified audits or reports, site visit records, third party organisations goods/services/materials country of origin mapping. • Medium visibility: supplier contract templates, verified audits or reports, copies of policies, some third-party organisation goods/services/materials geographic mapping. • Low visibility: none of the above.
How does your organisation engage with your suppliers on human rights and modern slavery issues?	Optional question encouraging supply chain engagement
Do you hold any certifications that address social risk, human rights or modern slavery?	Optional question to gather information, indication of risk mitigation, requires evidence of certification.
Does your organisation have a grievance mechanism or a way for workers and suppliers to make complaints or raise concerns?	Requires evidence. Mandatory question for high risk supplier/contractor. Indication of mitigation action and risk. Best practice is anonymous reporting hotline and whistle

What should be included?	Means of evaluation
	blower policy (ideally tailored for modern slavery).
Does your organisation have a formal process in place for regular auditing, or a regular assurance process for your organisation's high-risk operations or direct suppliers in relation to human rights or labour rights?	Requires evidence. Mandatory question for high risk supplier/contractor. Indication of mitigation action and risk.

6.2 Non-technical sustainability clauses

The following table details clauses that can be included in tender, request for quote, or contract documents for any general procurement.

Focus area	Example wording
Compliance with social and environmental laws and international norms of behaviour	[Supplier] represents and warrants that it conducts its business based on a set of values and guidelines for action and behaviour regarding people (including, without limitation, clients, employees, communities) and the environment; and that these values and guidelines are consistent with the fundamental principles (collectively, the “Principles”) outlined in: a) The International Labour Organization’s International Labour Standards. b) The OECD Guidelines for Multinational Enterprises. c) The Universal Declaration of Human Rights. d) The United Nations Global Compact.
	[Supplier] represents and warrants that it: (a) Has adopted a written policy that sets out its values and guidelines for action and behaviour regarding people (including, without limitation, clients, employees, communities) and the environment and such values and guidelines are consistent with the Principles. • And/or (b) Conducts its business in a manner that is consistent with the Principles.
	[Supplier] represents and warrants that the supplier is in [material] compliance with, and requires its subcontractors and any person under its [Control/control] to [materially] comply with, all applicable state, national, and international laws, rules and regulations relating to ethical and responsible standards of behaviour, including, without limitation, those dealing with human rights (including, without limitation, human trafficking and slavery and conflict mineral sourcing), environmental protection,

Focus area	Example wording
	sustainable development and bribery and corruption, including any legislation or regulation implementing the Principles (the “Rules”). [Supplier] has adopted and implemented appropriate and effective policies to ensure compliance with these Rules, including: (a) The implementation of due diligence and data collection procedures reasonably designed to monitor compliance with the Rules. (b) The establishment of internal review and accountability structures to oversee internal compliance with the Rules. (c) The coordination of [ongoing/annual/[TIME]] training and instruction for its employees [[and offering training and instruction to its/,] suppliers and subcontractors] regarding compliance with the Rules. (d) The requirement that its subcontractors certify their compliance with the Rules; and (e) The implementation of regular subcontractor audits, either directly or through a third-party auditor, to monitor compliance efforts.
Right to inspect	If [Council] reasonably believes the [Supplier] to be in violation of applicable Human Rights and/or Environmental Laws, then (a) [Council] shall have the right, from time to time, and upon not less than five (5) days’ written notice to [Supplier], except in the case of an emergency in which event no notice shall be required, to conduct an inspection. (b) Failure to conduct an inspection or to detect unfavourable conditions if such inspection is conducted shall not be a release of any liability for conditions subsequently determined to be associated with or to have occurred. [Supplier] shall remain liable for any condition related to or having occurred. The obligations set forth in this Section shall survive the expiration or earlier termination of the Contract.

6.3 Technical sustainability criteria

Inclusion of technical sustainability criteria for infrastructure and building products should be proportional to the risk and value of the procurement. For example, for a high-value construction project that has a high carbon and waste impact, council should request, at a minimum, that tenderers detail their organisations’ policies and standards that demonstrate commitment and experience in managing these risks along with management plans tailored to the project.

Focus area	What should be included?	Means of evaluation	Example of good practice
Greenhouse gas emissions	Does your organisation currently measure and report corporate greenhouse gas emissions? Or is your organisation compliant with the requirements of the National Greenhouse Gas and Energy Reporting System (NGERs)? If so, are scopes 1, 2 and 3 included?	• Reports including corporate emissions.	• Publicly reporting on greenhouse gas emission profile on an annual basis.
	Provide the estimated electricity consumption, fuel consumption, and the mix for each significant concrete mix intended for use for this project.	• Demonstrated calculations or previous projects.	• Evidence of calculations used or based on previous bill of quantities.
	Does the supplier have the plans, skills, systems and experience to reduce greenhouse gas emissions in the following areas? a) Stationary energy e.g., energy for site offices. b) Operational energy e.g., energy required for plant, equipment, and transport (including transport of materials and waste). c) Embodied emissions e.g., materials such as concrete and steel.	• Capability statements. • Qualifications. • Previous project experience. • Systems.	• Greenhouse gas emission reduction plans or similar in place, carbon neutral or product certifications, carbon reporting/accounting systems, previous construction project experience calculating greenhouse gas emission footprints.

Focus area	What should be included?	Means of evaluation	Example of good practice
Transport	What % of aggregates will be sourced locally? Note: using locally sourced aggregates will translate in 11t CO ₂ eq abated per km of road (1 lane).	Commitment to local supplier.	Bill of quantities or similar that indicates geographic location or business partnership with local supplier.
	What % of materials are transported locally, by sea, overland transport or by air? Note: consider setting a limit to the tonnes per km transported. Tonnes/km measures the total amount of weight transported; setting a limit incentivises construction contractors to source heavy materials locally or closer to the site, reducing total carbon emissions.	Commitment to % sourced by lower carbon options.	Bill of quantities or similar providing evidence of sourcing location and transportation method.
	What % of concrete will be precast/preference given to high % of precast over in-situ concrete. a) For 1m ³ concrete, precasting can lead to 10% reduction of carbon emission. b) Adoption of precast façade can reduce 2.1kg CO ₂ eq per m ² floor area.	Commitment to % or lower carbon materials.	Bill of quantities or similar providing evidence of % used.
Roads	What materials will be used and what % will be replaced with lower carbon materials? For example: a) Replacing standard concrete with 30% supplementary cementing materials will translate to 70t CO ₂ eq abated per km of road (1 lane). b) Replacing standard asphalt with 30% RAP asphalt will translate to 5t CO ₂ eq abated per km of road (1 lane).	Commitment to % or lower carbon materials.	Bill of quantities or similar.

Focus area	What should be included?	Means of evaluation	Example of good practice																																							
	c) Replacing standard concrete with 30% carbon neutral concrete will translate to 98t CO₂ eq abated per km of road (1 lane). d) Using recycled crushed glass as a replacement for sand in asphalt, pavements, for pipe bedding and as transition media for bio retention systems; can significantly reduce greenhouse gas emissions and increase the use of recycled resources. e) Non-structural concrete can use recycled plastic fibre instead of steel reinforcement e.g., e-mesh. f) Asphalt mixes can include RAP, toner, plastic, recycled glass, depending on type.																																									
Sustainable materials	Do any of your product(s) have an Environmental Product Declaration (EPD)? Note: EPDs are common for construction as a way of providing verified product evidence.	Copies of relevant certificates.	EPDs that are in line with the ISO standard and are currently valid.																																							
	Please complete the table below noting the % Australian sourced recycled content, sourcing location and carbon offset in materials. <table><tr><th>Materials</th><th>Supplier</th><th>% recycled content</th><th>% carbon offset</th><th>Location sourced (AUS/imported) list supplier & location</th></tr><tr><td>Crushed concrete</td><td></td><td></td><td></td><td></td></tr><tr><td>Crushed rock</td><td></td><td></td><td></td><td></td></tr><tr><td>Composites</td><td></td><td></td><td></td><td></td></tr><tr><td>Glass (recycled crushed glass)</td><td></td><td></td><td></td><td></td></tr><tr><td>Plastics</td><td></td><td></td><td></td><td></td></tr><tr><td>RAP</td><td></td><td></td><td></td><td></td></tr><tr><td>Timber</td><td></td><td></td><td></td><td></td></tr></table>	Materials	Supplier	% recycled content	% carbon offset	Location sourced (AUS/imported) list supplier & location	Crushed concrete					Crushed rock					Composites					Glass (recycled crushed glass)					Plastics					RAP					Timber					Completion of this table.
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Plastics																																										
RAP																																										
Timber																																										

Focus area	What should be included?					Means of evaluation	Example of good practice
	Metal						
	Textiles (shade cloth, fencing mesh)						
	Other (list)						
	What % of standard aluminium or standard steel will be replaced with aluminium or steel made from renewable energy, or timber?					Commitment to % or lower carbon materials.	Bill of quantities or similar providing evidence of % used.
	What % of Portland (standard) cement will be replaced with geopolymer concrete or supplementary cementitious materials ?					Commitment to % or lower carbon materials.	Bill of quantities or similar providing evidence of % used.
Waste management	Does the supplier/contractor have the plans, skills, systems and experience to minimise construction and demolition waste? Is this demonstrated within a site waste minimisation and management plan or similar?					- Capability statements. - Qualifications. - Previous project experience. - Waste management plans. - Site waste minimisation & management plan.	Good practice looks like – existing waste management plans, employees with 5+ years' experience in waste, and have achieved high diversion rates e.g., >70% diversion.

Focus area	What should be included?	Means of evaluation	Example of good practice
Waste management - textiles	Describe your approach to minimising textiles (fencing mesh or shade cloth) waste. For example: - avoidance of textiles with virgin plastic - where feasible using materials that include recycled content - participating in product stewardship programs such as Texback (led by the Vinyl Council of Australia) for PVC coated polyesters	• Commitment to % or lower virgin materials • Previous project experience. • Waste management plans.	• Bill of quantities or similar providing evidence of % used. • Demonstrated understanding of issue and plan to address.
Resource efficiency	Does the supplier have the plans, skills, systems and experience to reduce potable water construction?	• Capability statements. • Qualifications. • Previous project experience. • Water reduction plan.	• Good practice looks like previous experience demonstrating >15 % reduction.
Life-cycle costing (LCC)	Please provide the purchase price and all associated costs (delivery, installation, insurance, etc.).	• Data provided.	• Break down of costs across life of product or project or provision of invoices.
	Please provide the operating costs, including energy, fuel and water use, spares, and maintenance.	• Savings on use of energy, water and fuel. • Savings on maintenance	• Sample utilities bills for relevant operating costs.

Focus area	What should be included?	Means of evaluation	Example of good practice
		and replacement.	
	What are the end-of-life costs, such as decommissioning or disposal?	Savings on disposal costs.	- Example waste disposal invoices/tip dockets. - Supporting procedure/policies dictating required end-of-life protocol.
	What is the lifespan of the product (including how frequently does it need to be repaired or parts replaced)?	Evidence provided, verified independently or published externally.	Warranties or product information, product disclosure.
	Please provide the data availability, reliability and assumptions clearly outlining costs to be incurred in the future (for example, maintenance costs, energy consumption, as well as the product's actual lifespan).	Evidence provided, verified independently or published externally.	- Sample utilities bills for relevant operating costs. - Warranties or product information, product disclosure.
Minimise environmental pollution	Does the supplier/contractor have the plans, skills, systems and experience to minimise environmental pollution in construction works? Provide detail proven experience in:	Previous project experience.	Pollution control is standard and regulated practice

Focus area	What should be included?	Means of evaluation	Example of good practice
	a) Preventing construction materials, materials from roadworks, slurries and sediment laden water from entering council's stormwater system. b) Minimising noise pollution. In NSW, noise pollution is regulated through the Protection of the Environment Operations Act 1997 (POEO Act). The POEO (Noise Control) Regulation 2017 also sets certain limits on noise emissions from motor vehicles, vessels and domestic use of certain equipment. • c) And any other relevant pollution prevention experience and case studies.	• Site environmental management plan that specifically includes environmental and noise pollution.	for this sector, including for smaller contractors. • Good practice looks like environmental management plan or policy and previous experience.
Environmental Management System	Please provide experience in Environmental Management Systems for construction works that include: a) Use of recycled materials and the opportunities to reuse, recycle and dispose of goods responsibly. b) Installation of erosion and sediment control measures for the duration of works. Adequate protection to prevent sand, sediment, top-soil and the like from being washed, carried or blown from construction and other work sites. c) Plans for unexpected incidents and defined plan of action in the event of a pollution incident. The pollution incident plan must include on-site resourcing to minimise the environmental damage. d) Prevention of spillages and pollutants from entering drains or waterways via drainage systems. e) Onsite supervisor and worker induction, education and awareness of the necessary environmental and safety protection requirements. f) Minimisation and prevention of the release of noxious gases to the atmosphere.	• Previous project experience. • Pollution incident plan. • Evidence provided, verified independently or published externally.	• Pollution control is standard and regulated practice for this sector, including for smaller contractors. • Good practice looks like environmental management plan or policy and previous experience.
General sustainability	How can your business contribute to delivering this project in a sustainable manner (e.g., environmentally, socially and/or economically)? Provide details of any innovations, initiatives or best practices your business has implemented that will generate sustainable outcomes on the project, including KPIs and reporting metrics.	• Evidence provided, verified independently	• Good practice looks like – innovations, awards,

Focus area	What should be included?	Means of evaluation	Example of good practice
		or published externally	measured impact, trials of new technology or products or services

6.4 Technical sustainability clauses

The following clauses are the minimum requirement that should be met by infrastructure and building industry professionals working on council projects and can be included in tender, request for quote, or contract documents for any general procurement. These requirements:

- Have been largely adopted from Green Building Council of Australia's (GBCA) Green Star Rating Tools.
- Aim to encourage management practices that minimise the amount of construction and demolition waste that is disposed to landfill.
- Include waste material produced during the construction, demolition or deconstruction of buildings and their infrastructure such as (but not limited to) concrete, wood, metals, plasterboard, cardboard, plastics, asphalt, textiles and mixed site debris like soil and rocks.
- Exclude excavation waste and special waste.

Focus area	Example wording
Waste technical specifications	All contractors and subcontractors to report on all waste generated onsite. Specify whether materials were sorted separately and how they are re-used, recycled, or disposed of offsite (please identify where each material is taken for recovery or disposal). The successful contractor will be required to report on the amount of waste materials recovered, and outline measures for avoiding contamination in waste storage, transport and disposal.
	Use modular formwork where possible.
	As per the regulated waste legislation, ensure that all regulated wastes are stored, transported, tracked and disposed of correctly.

Focus area	Example wording
	Ensure that no construction waste or litter enters the stormwater systems and waterways.
Resource recovery targets	Commitment to achieving a x% or greater diversion from landfill for all strip-out waste generated during the project, and at least 90% of waste generated during construction and demolition. This commitment is to be demonstrated via: a) Submission of a Resource Recovery Plan, calculating the expected recycling target for all strip out materials, including accurate estimations of material onsite and evidence of their planned avenues for reuse, recycling, or disposal. Contractors will be held to the fulfillment of their Resource Recovery Plan and be required to present evidence of having delivered it, but not be penalised for failure to meet a certain recycling target. b) As a minimum, it is expected that the following should be source separated for recovery: i. Hardfill (inc. concrete, tiles, etc.), ii. Clean fill (earthworks, soils, sands, aggregates), iii. Timber productions, iv. Plasterboard, v. Glass (inc. laminated), vi. Ceiling tiles, vii. Metals, viii. Carpet and soft furnishings (curtains, cushions etc.), ix. Furniture, x. Plastics, xi. E-waste, xii. Signage (e.g. TexBack for vinyl banners) xiii. Mixed waste. c) Commitment to complete a Resource Recovery Report prior to Practical Completion, confirming the total amount of construction waste generated, all major waste streams, achieved recycling rate and supporting documentation.
Sustainability management plan	The Contractor must prepare a Sustainability Management Plan setting out the Contractor's approach to achievement of the sustainability requirements of the Contract. The SMP must: a) Provide a statement of the scope, purpose and objectives in relation to sustainability. b) Must align with the client's [sustainability policy/strategy/principles/goals] and demonstrating how the Works and Temporary Works (as applicable) will contribute to the achievement of the client's sustainability goals.

Focus area	Example wording
	c) Identify the Contractor's Project Management Team representatives responsible for the implementation of the SMP and achievement of the sustainability requirements. d) Identify roles and responsibilities to establish and manage the systems, processes and activities described in the SMP, and achievement of the sustainability requirements set out in this Contract. e) Describe the systems, processes, procedures and activities the Contractor will implement and maintain to achieve the sustainability requirements of the Contract, including: i. Integration with of all Project Plans and key disciplines, including procurement, risk, design, engineering, construction and stakeholder management. ii. Communication and awareness processes for ensuring personnel are aware of their roles and responsibilities in relation to sustainability. iii. Training and education processes for ensuring personnel possess the necessary skills and knowledge to fulfil their roles and responsibilities in relation to sustainability. iv. Engagement activities with key disciplines to identify sustainability opportunities and initiatives for implementation. v. A change management process that details how the Contractor will manage the impact of changes in scope, design (including changes to the Design Documents), and Key Personnel to ensure sustainability requirements are achieved. vi. Data collection and reporting systems to track progress against and demonstrate compliance with sustainability requirements; and vii. Monitoring, auditing, reporting and management review processes. f) Contain the Sustainability Risk and Opportunities Register.
Sustainability risk and opportunities register	The Contractor must develop a Sustainability Risks and Opportunities Register, and it must: a) Include a listing of the risks to the achievement of the sustainability requirements and identify their mitigation measures. b) Include a listing of opportunities that the Contractor plans to investigate and implement as part of achieving the sustainability requirements.
Greenhouse gas reduction	Develop an Emissions Reduction Plan including emissions reduction targets and identify and prioritise energy reduction and greenhouse gas reduction initiatives for implementation.

Focus area	Example wording
	The Contractor must offset at least 25% of the electrical energy consumed in carrying out the project activities. This may be through the purchase of: a) Large-scale generation certificates, or b) Renewable energy from an Australian Government accredited renewable energy supplier, or c) A combination of both.
	The Contractor must capture and report the project activity's greenhouse gas data consistent with the requirements of the National Greenhouse Gas and Energy Reporting System (NGERs).
	The Contractor must ensure that all vehicles, plant and equipment, are: a) Fitted with diesel particulate filters, catalytic converters or equivalent wherever feasible. b) Not left idling when not in use. c) Can provide evidence of regular maintenance and service history
Construction waste management plan	The Contractor must prepare a Waste Management Plan setting out the Contractor's approach to achievement of the waste goals of the Contract. The Waste Management Plan must include: a) Provide a statement of the scope, purpose and objectives in relation to sustainability. b) Must align with the client's [waste policy/strategy/principles/goals] and demonstrating how the Works and Temporary Works (as applicable) will contribute to the achievement of the client's waste goals. c) Identify the Contractor's project management representatives responsible for the implementation of the WMP and achievement of the waste goals d) Identify roles and responsibilities to establish and manage the systems, processes and activities described in the WMP, and achievement of the waste goals set out in this Contract. e) Describe the systems, processes, procedures and activities the Contractor will implement and maintain to achieve the waste goals of the Contract, including: i. Integration with of all Project Plans and key disciplines, including procurement, risk, design, engineering, construction and stakeholder management. ii. Communication and awareness processes for ensuring personnel are aware of their roles and responsibilities in relation to waste management. iii. Training and education processes for ensuring personnel possess the necessary skills and knowledge to fulfil their roles and responsibilities in relation to waste management. iv. Engagement activities with key disciplines to identify opportunities and initiatives for implementation.

Focus area	Example wording
	v. Data collection and reporting systems to track progress against and demonstrate compliance with waste goals, and vi. Monitoring, auditing, reporting and management review processes. g) Provide description where the materials will be taken and how the recycling facility will process the material, and h) Specifying measures for tracking total and diverted waste amounts and material streams.
Pollution	As a contractor you will need to carefully manage the potential effects from your waste management activities and undertake the necessary precautions and waste management protocols to prevent environmental contamination from plastic and other pollution.
Unrecyclable materials	Below is a list of commonly unrecyclable materials that are likely to occur during your construction and demolition activities. Avoidance of these waste types is a requirement, where that is not possible reuse of these materials must be included in reporting: a) PPE (hardhats and protective eyewear). b) Treated timber. c) PVC Pipes d) Textiles; and e) Some types of plasterboard: i. Accepted: Only standard plasterboard is accepted ii. Not accepted: Ultraline, Toughline, Fyrelime and Aqualine & X-Block.
Material selection & quality expectations (Including textiles)	Recycled content – can virgin materials be replaced by recycled content in the product or material?
	Recyclability – can the product or material easily be recycled or composted in practice and at scale in Australia? Are product stewardship programs available for example: Texback (led by the Vinyl Council of Australia) for PVC coated polyesters
	Resource efficiency – has this product or material being efficiently manufactured with less materials being used to produce the same product? Is there data available to support this, e.g., life cycle assessment, embodied energy calculations?
	Salvage and reuse – are there second-hand parts that can be used? Can this product or material be reused? Are extended producer responsibilities applicable

Focus area	Example wording
	Durability – is this product or material durable? How quickly will it need to be replaced?
Training and Education	Contractors are responsible for running site-specific waste specific inductions to all staff and/or relevant subcontractors that are carrying out Construction & Demolition activities. This that should outline the components of your WMP and explain the site-specific practicalities of the waste reduction and recycling strategies in place.
	Using images in training sessions and training materials, particularly where staff and sub-contractors may not have English as their first language;
Ongoing Reporting Requirements	Cumulative waste report generated from the monthly waste reports must be provided by the waste contractor over the entire duration of all construction and demolition or refurbishment documents. a) Supporting waste disposal dockets will not be required but should be made available when requested. b) To calculate the amount of waste diverted from landfill, the project team is required to report the total amount of waste generated from the refurbishment, the amount sent to landfill, and the amount of all recyclable/reusable wastes sent to processing facilities. c) The Contractor must: retain appropriate, complete and accurate records); and d) Provide the [Council/Manager] with those records upon written request.

6.5 Optional material-specific performance standards, clauses and controls

The following performance standards, clauses and controls can be used on waste-management tenders, requests for quote or contracts where more specific detail is required from suppliers.

Material specific performance standards	
Material specific diversion targets	Divert 100% of concrete, hard-fill and clean-fill from landfill.
	Ensure that 100% of waste oil is recycled.
	Achieve recycling rate of 80% scrap metals (ferrous & non-ferrous) from any demolition and construction activities.

	Achieve recycling rate of 80% of cardboard, paper and plastic waste (including clear soft plastic, pallet wrap and packaging).
	Achieve recycling rate of 80% untreated hardwood timber waste and green waste.
Activity specific controls	
Waste management	Designate and clearly label each bin and recycling stream at the waste storage areas so people know how the sorting system works.
	Develop induction information to explain the waste management system or create a waste section in your regular induction information.
	All contractors, subcontractors arrange recycling bins for all recyclable streams throughout the project.
	All contractors to ensure that cardboard, paper, soft plastic wrapping and organic waste is captured and recycled using designated bins.
Textiles (carpet)	Carpet must be modular (carpet tiles) in order to extend life of carpet (minimise replacement by targeting high impact areas only) and maximise alternatives for end of life.
	End of life options must be specified including product recycling, take back or stewardship schemes.
Carpentry/Joinery	Order pre-made framing and joinery to avoid off-cuts onsite.
	Prepare accurate cutting lists before ordering and use off-cuts wherever possible before cutting new lengths.
	Keep treated and untreated waste timber separate at all times. Clearly label each bin or area.
	Have a single timber cutting area to keep all offcuts in one designated bin or pile. Staff and contractors can help themselves to offcuts during the project.
	Consider if untreated timber can be used for firewood (staff, the public or charities). Provide a dedicated bin or pile.
	Order pre-made framing to avoid offcuts on site and prepare accurate cutting lists before ordering.
Vegetation	Vegetation from earthworks should be reused onsite (where possible) or diverted for landscaping purposes offsite.
	Vegetation waste should be shredded or processed into wood chip or mulch and can be used in the rehabilitation of areas disturbed during construction, and for landscaping.

Earthworks/excavation	Where excavated material needs to be stockpiled for the efficient operation of the works, it will be placed at a designated stockpile area.
Welding/steel	Use offcuts wherever possible before cutting new segments and/or reweld offcuts wherever possible before cutting new lengths.
	Store steel waste with all other metal waste for recycling.
Concrete/brickwork	Ensure surplus cement is stockpiled and used for onsite reclamation.
	Store waste concrete separately from other waste for use in reclamation.
	Use recycled concrete aggregate as a base course in civil works.
	Reuse formwork, wooden boxing and timber scraps where possible.
	Recycle broken bricks and tiles with waste concrete.
Plasterboard	Store clean (standard) construction plasterboard waste separately for recycling.
	Keep demolition plasterboard separate, as demolition plasterboard is more difficult to recycle and may contaminate the waste.
Electrical	Recycle electrical offcuts with other construction metal and strip insulation from wire prior to recycling.
Excess materials or products	Return oversupplied materials to the supplier and/or use on the next job.
	Separate and protect materials for salvage – store under cover and away from waste.

Appendix A – Behaviour Change Activity Outputs

The tables below feature the behaviour change workshop outputs for each material.

1. Asphalt alternatives

Reclaimed Asphalt Pavement

Request process	Barriers	Trade off
1. New contract – specifications 2. Blanket contracts, long term contracts, so we get a list of suppliers. 3. Make sure that those suppliers can provide the material 4. Identify the need 5. Monash: Design Engineer; Urban Design team; Capital Works Project Manager, Procurement review 6. Glen Eira Contact: Infrastructure renewals team 7. Dollar figures are most likely confirmed, we need to get really early so we know the cost implication. 8. Stonington: Sustainability team needs to know the alternative and intervene at a very early step.	• Maintenance budgets aren't costed into procurement • Business as usual is essay • Real Gap between policy and strategy and between what happens at an operational level. • Separation between what is being said and what is happening • Lack of support for people doing the sign off • Lack of leadership • People don't think strategic • Added complexity of whole of life costs • It is complex and time consuming. People won't take the time • Products being available to contractors • Not very much sharing between councils	No mural information.
	Enablers • Request variations as a group-to-group contract? • Grant funding • Peer to peer sharing and learning (engineer to engineer) across councils • Making the process easier • Trickle down form upper management and get them to instinctive the system • Anything that simplifies would be beneficial • Getting in at the right time... at the beginning of projects	Opportunities No mural information.

	• Bribing other teams... give them money if they use sustainable materials • Peer to Peer learning • Making it easier to find information. • List of suppliers • Sharing the success from other councils • Cover the cost or contribute to the project if they become more successful	
Receive process	Barriers	Trade off
• Contractor laying asphalt needs to be confident in availability of and using product • We want to see what is claimed to be true • Having a champion works, because the one that is in charge is pushing • Long lead time from trial to business as usual • Having a good supplier relationship • Opportunity to share learning • Have an internal panel for roads • Put into contracts so it is easy to replicate	Limited follow up and sharing of lessons learnt from projects	No mural information.
	Enablers	Opportunities
	No mural information.	No mural information.

2. Concrete alternatives

Mass Timber

Request process	Barriers	Trade off
1. Council gets allocated X money to build Y 2. If there's an existing policy that will unpack the outcome	• Specificity of policy updates could be a barrier to action • Availability and cost • Knowledge and time to assess/research • Materials are generally down to suppliers	• X amount to build, we will prioritise community need or sustainable materials

3. Council to council team members to discuss design brief and requirements 4. Design brief doesn't current include materials 5. Councils can't specify the material, but they can add material criteria specification to include X% recycled content 6. Design doesn't consider sustainable outcomes	• Not really a long-term view in terms of ROI • Really does come down to cost • Policies cover buildings not infrastructure • Councils have not historically prescribed, and these qualities of materials haven't been in the process • Need policy level buy in • Visual design and look of buildings • We thought suppliers would come to us with new materials, but it has to be council driven • Supply • Design, has to be different	• Design and where it is in the process • Community need • Interested to do it if we can show cost efficiencies • Environment/location fire • Managing expectations and stakeholders
	Enablers	Opportunities
	• Have been using this for steel • Very engaged but under more financial pressure • Support from projects team at Maroondah • Need to show costs benefits and influence tender decisions	• RTO life span cost benefits • Policy level commitment • Sustainability officers could have an endorsed policy from council • New infrastructure will need to specify material • Passionate individuals
Receive process	Barriers	Trade off
No mural information.	• No monitoring or evaluation of responses and buildings after the fact • types of materials can impact machinery • Need to capture community demand • More prone to Storm damage • Unknown - concerns around the delays, strength, duration etc • Not sure whether suppliers/contractors are motivated	• Currently take the suppliers word, rather than checking • May need more checks and balances required.
	Enablers	Opportunities

	- Helps if the contractors have dealt with the product before - Maintenance and installation are easier and cheaper - Big focus on council being the leader in built environment and infrastructure. - Aware off products / materials	Community and local companies driving demand
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Low Carbon Concrete

Request process	Barriers	Trade off
No mural information.	- Concerns about the product ability/fit for purpose - Technical know-how of suppliers and internal assessors - Location	Types of usage
	Enablers	Opportunities
	- Real world application - Scope 3 emissions reductions - Improved durability / maintenance	Need real world examples to help reduce risk aversion
Receive process	Barriers	Trade off
No mural information.	No mural information.	No mural information.
	Enablers	Opportunities
	No mural information.	No mural information.

3. Steel alternatives

Mass Timber

Request process	Barriers	Trade off
- Concept phase - Brief the consultant - Determine product is fit for purpose	- Does procedure or policy being weighted effectively - Fire concern - Termites - Is it easy to replace the incumbent product	- Overseas sourcing - Lack of experience - Recyclability

4. In line with strategy for carbon neutrality 5. Council strategy 6. Risk assessment process 7. Does the CEO have an agenda 8. Community vision 9. Project management engagement - reinforce direction 10. Continual reinforcement 11. Manage community engagement 12. Does procurement process sit with new or changing vision 13. Every council is different for policy and procedure 14. Specifications and standards must be met 15. Aesthetics to fit with natural environment 16. Fit for purpose 17. Build it. 18. Use and maintenance 19. Life cycle 20. Community engagement	- Managing risk adverse stakeholders - Lack of experience in trades	
	Enablers	Opportunities
	- Cost saving - Community expectation - Carbon impact - A powerful voice in the room - Improved communication - community, internal and external stakeholders	- Looks better - Labour rights - Availability
Receive process	Barriers	Trade off
1. Community education 2. Specs and standards imported to system 3. Engagement from consultants 4. Promote to engineers and partners 5. Promote to community	Local suppliers	- Opens opportunities for alternative local supplier - Educate steel manufacturers as to why the change
	Enablers	Opportunities
	- Other council case studies - Proof to engineers	- Active suppliers - Competitive costs

Low Carbon Steel

Request process	Barriers	Trade off
No mural information.	No mural information.	No mural information.
	Enablers	Opportunities
	No mural information.	No mural information.
Receive process	Barriers	Trade off
No mural information.	- Decentralised procurement - Ease of access - Are the product claims validated / certified. - Key contractor networks and relationships	- Approved suppliers in council - Where do councils need to go for information
	Enablers	Opportunities
	- Retain look and feel, but drop structural equivalence - SV product directory - Ease of access?	- Understanding the options available and what they can do - Encourage the manufacturers to be proactive in communication

4. Crushed Rock and Gravel alternatives

Recycled Aggregate

Request process	Barriers	Trade off
- Make sure you have budget available - Understand materials exist, know what to look for and where to find it - Having policy direction and appropriate process to follow - Design step, product is fit for purpose - Design process information estimated cost	- Proscriptive materials in competitive process - If structural product often the performance standards are higher than actually required - risk adversity - International comparisons do not resonate. - It hasn't been tested, it hasn't been in the ground for 50 years	No mural information.
	Enablers	Opportunities

• Design guidelines • Making sure the evaluation criteria allow for quantitative analysis	• Engineers are the opportunity and the challenge: targeted communication, education, behavioural change program • Evolution not revolution	• Trial on car park to provide confidence on material performance • Communicate the benefits of these engineers • Standards have a big impact - having standards established locally will guide adoption • Case studies, celebrate the successes
Receive process	Barriers	Trade off
No mural information.	• Assessment - evaluation. When there is no standard or certification, what do you compare with • Time constraints to assess granular detail to create change/alternate material selection • Right people in the evaluation process with technical knowledge • Credibility in the data/responses	No mural information.
	Enablers	Opportunities
		• Green building standard • Having the confidence, the material you are buying meets the objectives & performance • Supplier panels with clearly marked capabilities in alternate material/recycled material, that is vetted and verified • Transition plans with timelines to move to recycled outcomes gives

		the market the opportunity to have solutions in place
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5. Brickwork alternatives

Mass Timber

Request process	Barriers	Trade off
- Identify and/or develop strategic overarching supporting policy (strategic) - Find internal champions for product (strategic) - Research Product (procurement) - Provide information to procurement (procurement) - Procurement to create/add to product guide/buy book (procurement) - Continue education and comms process (strategic)	- Cost - Limitations in application - structural properties. Knowledge required - not like for like - Familiarity/comfort with status quo	Product life
	Enablers	Opportunities
	- Defined parameters for recycled content in ESD policy - Willingness to try new things	No mural information.
Receive process	Barriers	Trade off
- Dependent on project type: Major Projects - Full Public Tender - Product part of Brief. For specific product - project brief and 3 quotes process up to \$\$ tender limit - Complete Tender process - Goods Supplied - Project finished - Review of Product/Project	- Availability of product/suppliers - Chicken and egg kind of issue - Potentially needing to get an exemption if limited supply - reliant on strategic support	Existing suppliers may fold if not receiving the work any more
	Enablers	Opportunities
	- Local providers - Council reporting processes - I.e., climate	Councillor Support

No information was recorded for:

Rubberised Asphalt Concrete, Manufactured Aggregate, and Carbon Neutral Bricks.

Appendix B – Example Project Action Plan

A working example of a project action plan to identify the recycled and/or circular economy opportunities across a project lifecycle, to achieve project targets.

				TARGETS								DETAILS TO BE CONFIRMED						
				TBC	30%	10%	10%	10%	80%	TBC	95%							
				Recycled First	Low Carbon Concrete	Materials	Greenhouse gasses (GHG)	Water	Inert and non-hazardous waste	Office waste	Topsoil							
Initiative	Sub-Initiative	Base case	Type									Design?	Delivery?	Stakeholders?	QTY Estimate?	Quotes?	Other benefits?	
Recycled asphalt	> Recycled Asphalt Pavement (RAP)	0% RAP	BAU	x		x						Yes - specification	Yes - procurement	No	Yes - asphalt type, layer & m3	Yes - normal asphalt suppliers	Reputation/publicity + Government priority	
	> Glass sand	None	BAU	x								Yes - specification	Yes - procurement	No	Yes - asphalt type, layer & m3	Yes - normal asphalt suppliers	Reputation/publicity + Government priority	
	> Crumb rubber	None	BAU	x		x						Yes - specification	Yes - procurement	No	Yes - asphalt type, layer & m3	Yes - normal asphalt suppliers	Reputation/publicity + Government priority	
	> Plastics	None	BAU	x		x						Yes - specification	Yes - procurement	No	Yes - asphalt type, layer & m3	Yes - normal asphalt suppliers	Reputation/publicity + Government priority	
	> Low carbon concrete trial	None	Opportunity									Yes - specification	Yes - procurement	Yes - DOT, MRPV, S	Yes - asphalt type, layer & m3	Yes - normal asphalt suppliers	Reputation/publicity + Government priority	
Recycled aggregates	> Crushed concrete replacing CT roadbase	CT roadbase	BAU	x		x						Yes - specification	Yes - procurement	No	Yes - pavement layers & tonnes	Yes - normal concrete suppliers	Reputation/publicity + Government priority	
	> Crushed glass (e.g. bedding)	Sand	BAU	x		x						Yes - specification	Yes - procurement	No	Yes - pavement layers & tonnes	Yes - specific providers	Reputation/publicity + Government priority	
Low carbon concrete	> Prioritise asphalt in the design	Concrete	BAU	x		x						Yes - specification	Yes - procurement	No	No	No		
	> Minimum cement replacement target	15% SCM	BAU			x	x					Yes - specification	Yes - procurement	No	Yes - concrete applications, strength, QTY (m3)	Yes - normal concrete suppliers	Reputation/publicity	
	> Geopolymer concrete (curbs, channels)	None	Investigate			x	x					Yes - specification	Yes - procurement	No	Yes - concrete applications, strength, QTY (m3)	Yes - specialist suppliers	Reputation/publicity + Government priority	
	> Emesh (recycled plastic fibre)	Steel reo	BAU	x		x						Yes - specification	Yes - procurement	No	Yes - concrete applications, strength, QTY (m3)	Yes - normal concrete suppliers	Reputation/publicity + Government priority	
	> Low carbon concrete trial	None	Opportunity			x	x					Yes - specification	Yes - procurement	Yes - DOT, MRPV, Supplier, University	Yes - normal or specialist concrete suppliers	Yes - normal concrete suppliers	Reputation/publicity + Government priority	
Renewable energy	> Solar PV on fixed infrastructure (lighting, VMS etc.)	Mains	Investigate				x					Yes - location & feasibility	No	No	No	Yes - normal PV manufacturers & installers	Reputation/publicity + Government priority + Regional jobs	
	> Solar or mains powered lighting tower, VSLs	Diesel	BAU				x					No	Yes - planning and procurement	No	Yes - # towers, duration	Yes - retail/rental providers	Reputation/publicity + Government priority	
	> Solar or mains powered site sheds (location - river p	Diesel or mains	BAU				x					No	Yes - planning and procurement	No	Yes - # sheds, capacity, duration	Yes - retail/rental providers	Reputation/publicity + Government priority + Regional jobs	
	> Hybrid or biodiesel plant	Diesel	Investigate				x					No	Yes - planning and procurement	No	Yes - plant & hours	Yes - retail/rental providers	Reputation/publicity + Government priority	
	> Hybrid site vehicles	Petrol	Opportunity				x					No	Yes - planning and procurement	No	Yes - # vehicles	Yes - retail/rental providers	Reputation/publicity + Government priority	
Energy reduction	> Electric site vehicles	Petrol	Opportunity				x					No	Yes - planning and procurement	No	Yes - # vehicles	Yes - retail/rental providers	Reputation/publicity + Government priority	
	> Carbon neutral construction (including offsets)	None	Opportunity				x					No	No	No	Yes - fuel and electricity use estimates	Yes - carbon offset providers	Reputation/publicity + Government priority + Australian first	
	> LED streetlighting	LED	BAU				x					Yes - specification	No	No	No	No		
	> Reusing existing features (e.g. pavement, hardstand	Removal or new	BAU				x	x				Yes	No	No	No	No		
	> Intelligent compaction	?	Opportunity				x	x				No	Yes	No	Yes - m3 saved	No		
Recycled plastic	> Mass Soil Mixing (MSM) for ground improvement.	Concrete Modulus Column	Opportunity				x	x				No	Yes	No	Yes - m3 saved	No		
	> Green pipe (recycled) - (Blackbacks - Vinidex) - plex	100% virgin plastic	BAU	x		x						Yes - specification	No	No	Yes - diameter and length	Yes - suppliers	Reputation/publicity + Government priority	
	> Barriers or walls - panels over retaining walls		Investigate	x		x						Yes - Urban Design	No	No	Yes - dimensions	Yes - suppliers	Reputation/publicity + Government priority + Social procurement	
	> Furniture		Opportunity	x								Yes - Urban Design	No	No	Yes - quantity and type	Yes - suppliers	Reputation/publicity + Government priority + Social procurement	
	> Spoil transport (quarry clean fill only)	Average	BAU				x					No	Yes - procurement	No	No	Yes - consider in procurement process		
Logistics optimisation	> Asphalt supplier	Average	BAU				x					No	Yes - procurement	No	No	Yes - consider in procurement process		
	> Concrete supplier	Average	BAU				x					No	Yes - procurement	No	No	Yes - consider in procurement process		
	> Tree retention	Ref. design	Investigate				x					Yes - design footprint	Yes - footprint required, vegetation clearance process	Yes - Local amenity	Yes - footprint (m2) and number & type of trees	No	Goodwill/stakeholders	
Timber & vegetation	> Deliver timber to Councils	None	BAU									No	Yes - logistics, storage and timing	Yes - Local councils	Yes - footprint (m2) and number & type of trees	No	Goodwill/stakeholders	
	> Deliver timber to Parks Victoria	None	BAU									No	Yes - logistics, storage and timing	Yes - Parks Victoria	Yes - footprint (m2) and number & type of trees	No	Goodwill/stakeholders	
	> Firewood/sell to community	None	Investigate				x					No						
	> Offset planting in local council areas	None	Investigate				x					No	No	Yes - Local councils	Yes - footprint (m2) and number & type of trees	Yes - tree planting costs (could be shared)	Goodwill/stakeholders	
	> On-site reuse - furniture or urban design	None	Opportunity				x					Yes - Urban Design	Yes - logistics, storage and timing	Yes - Manufacturer	Yes - footprint (m2) and number & type of trees	Yes - identify supplier	Goodwill/stakeholders	
Topsoil reuse	> On-site artwork	None	Opportunity				x					Yes - Urban Design	Yes - logistics, storage and timing	Yes - Artist	Yes - footprint (m2) and number & type of trees	Yes - identify supplier	Goodwill/stakeholders	
	> Landscaping on-site (need to find export solution)	N/A	BAU				x			x		Yes - Urban Design	Yes - logistics, storage and timing	No				
	> Provide to Councils	N/A	BAU															
Non-potable water use	> Rainwater capture and storage - toilet flush	Potable water	BAU					x				No	Yes - location	No	No	Yes - supply and install providers	Goodwill in the instance of drought	
	> Dust-suppression polymers	None	Investigate					x				No	Yes - acceptability	No	No	Yes - polymer suppliers	Goodwill in the instance of drought	
	> Source Class A recycled water	Potable water	Investigate									No	Yes - acceptability	No	No			
Waste management	> Off-site separation of construction & demolition waste	N/A	BAU						x			No	No	No	No	Yes - major demo contractors		
	> Source separation of office waste	Red bin only	BAU							x		No	No	No	No	Yes - normal waste collection contractors		
	> Source separation of construction & demolition waste	N/A	BAU						x			No	No	No	No	Yes - normal waste collection contractors		

Appendix C Sustainable Development Goal for Public Procurement and Municipal Sustainable Procurement Indicators

The following data indicators represent the United Nations Environment Program's (UNEP) reporting framework to assess federal, state and city/municipal progress against Sustainable Development Goal 12.7.1. indicator on Sustainable Public Procurement (SPP), officially designated as the "Number of countries implementing SPP action plans and policies".

Sustainable Development Goal 12 (SDG 12) is "To ensure sustainable consumption and production patterns". For SDG 12, target 12.7 is "Promote public procurement practices that are sustainable, in accordance with national policies and priorities."

Target 12 indicator of the "Degree of sustainable public procurement policies and action plan implementation" refers to the capacity of governments to undertake procurement that ensures economic and social development while protecting the planet and reducing the negative impacts in the environment.

The reporting framework provided below in Table 2 is a robust checklist to assess what type of sustainability measures should be in place across processes and documentation, with associated metrics to report against. By integrating these areas and metrics into processes EAGA member councils will be prepared to provide data to assist national data collection for SDG 12.7.1 progress reporting.

Table 2: Sustainable Development Goal 12.7.1 Reporting Checklist

Existence of a Sustainable Public Procurement (SPP) Action Plan and/or Policy and/or Sustainable Public Procurement Regulatory Requirements		
A municipal/city SPP action plan, policy, SPP regulatory requirements have been developed and approved by the government	Yes	No
OR a related national, provincial, regional plan, policy, regulatory requirement already applies to your local government procurement	Yes	No
Action plan, policy related documents and/or relevant regulatory requirements are externally accessible online	Yes	No
The Public Procurement regulatory framework is conducive to sustainable public procurement		
Provision in the legal and regulatory framework allow for sustainability considerations (environmental, social) to be incorporated at the following stages of the procurement process:		
1. Defining technical specifications	When defining technical specifications, public authorities can resort to:	
Sustainability requirements (environmental, social) can be included in technical specifications: When defining minimum compliance criteria for a contract sustainability requirement can be specified. E.g. use of sustainable / recycled raw material; biodegradability of products; avoidance of use of harmful substances; environmentally friendly packaging; power consumption level; warranty of durability; guarantee of availability of parts & components.	Yes, sustainability requirements can be included in technical specs	No, such criteria, standards, or labels cannot be used

Type I Eco-labels, social labels, or relevant sustainability standards: can be used as a reference to specify the minimum level of compliance	Use, type I eco-labels or sustainability standards can be used as reference	
Functional / Output-based / Performance-based specifications can be used as criteria: Such specifications indicate what the procured items should achieve in terms of the functions performed, the level of performance reached, or the delivered outputs / outcomes (e.g. light bulbs with limited energy consumption, or vehicles with limited CO2 emissions).	Yes, functional, output-based, and / or performance-based specifications can be used	No, they cannot be used as criteria
2. Sourcing of suppliers	<i>Can sustainability related selection or exclusion criteria be applied when sourcing suppliers?</i>	
Sustainability requirements can be specified as pre-qualification / selection criteria: Selection criteria assess the suitability of an economic operator to carry out a contract. E.g. suppliers may be asked to provide proof of compliance with social or environmental standards, evidence that they have adopted an environmental management system approach or a supply-chain management and tracking system.	Yes, sustainability requirements can be specified as pre-qualification / selection criteria	No, it is not possible
Sustainability requirements can be specified as exclusion criteria: Suppliers in breach of environmental or social laws, or, not complying with certain environmental or social standards (such as ILO core conventions), can be excluded from the procurement process.	Yes, sustainability requirements can be specified as exclusion criteria	No, it is not possible
3. Award Criteria	<i>Can sustainability related selection or exclusion criteria be applied when sourcing suppliers?</i>	
The legal and regulatory framework allows for contract award to be based on criteria other than price (including sustainability criteria). E.g. "Best Value for Money" or "Most Economically Advantageous Tender (MEAT)" approaches.	Yes, contract award can be based on such approaches / criteria	No, contract award cannot be based on such approaches / criteria
The legal and regulatory framework allows for life-cycle costing (LCC) to be used in the evaluation of tenders: LCC means considering all the costs that will be incurred during the lifetime of a product, work or service (purchase price including delivery, installation costs; operating costs and maintenance; end-of-life costs such as disposal). <i>Source: Buying Green, EU Handbook on GPP</i>	Yes, life-cycle costing can be used	No, life-cycle costing cannot be used
4. Contract Performance	<i>Can sustainability related selection or exclusion criteria be applied when sourcing suppliers?</i>	
Sustainability requirements can be specified in contract performance clauses: E.g. Requiring compliance with labour rights in the supply chain (i.e. ILO core standards); requiring an efficient use of resources such as electricity and water on construction sites; reduction of	Yes, contract performance clauses	No, contract performance clauses cannot specify

CO2 emissions associated with transport; packaging taken away for reuse, recycling or appropriate disposal.	can specify sustainability requirements	sustainability requirements
Provision in the legal and regulatory framework mandate the procurement of sustainable alternatives:		
Is the procurement of sustainable alternatives:	<i>The procurement of sustainable alternatives is:</i>	
Possible/voluntary: the legal and regulatory framework allows the practical implementation of SPP. Public authorities may choose to procure more sustainable alternatives	Yes, it is mandatory to procure sustainable products/services at least for some categories	No, it is NOT mandatory (only possible) to procure sustainable products/services
Mandatory: the legal and regulatory framework mandates the procurement of sustainable products/services, at least for some categories. Example 1: The procurement of sustainable alternatives is mandatory for some categories of products/service. E.g. EU "Clean Vehicles Directive" making it mandatory for contracting authorities to take energy and environmental impacts into account when purchasing road transport vehicles. Example 2: The procurement of sustainable alternatives is mandatory whenever products falling to "priority "categories (product groups for which specific labels, specification or minimum sustainability criteria have been identified), are procured. E.g. public administrations may have to mandatorily procure more sustainable alternatives from an official catalogue of products bearing the national ecolabel.	Yes, it is mandatory to procure sustainable products/services at least for some categories	No, it is NOT mandatory (only possible) to procure sustainable products/services
Practical Support delivered to procurement practitioners on the implementation of SPP/GPP		
Guidelines and tools, or an official catalogue of eco-labelled products, have been developed and are <u>periodically revised</u>	Yes	No
Specific communication channels (newsletter, website, intranet, social media, etc.) are used to provide information or tools to procurement practitioners, at least twice a year.	Yes	No
Training sessions are organised at least once a year to build the capacity of public procurement practitioners in the implementation of SPP/GPP.	Yes	No
Best practice or (at least 3) case studies are shared with procurement practitioners (please only take account of studies developed in the last 3 years), which may include the translation of relevant documents developed by other countries	Yes	No
A helpdesk is available for procurement practitioners	Yes	No
SPP Purchasing criteria / buying standards / requirements		

Environmental criteria		
Commonly found categories of products and services to be used as reference for evaluation	Have environmental criteria been defined, or environmental standards / labels been recommended for specific categories of products?	If label(s) has(have) been recommended for those products, what kind of label?
- o Appliances (commercial and residential appliances, such as clothes washers, refrigerators, etc.) - o Building interior products (carpeting, wallboards, paint and stains, etc.) - o Healthcare, biomedical equipment and supplies - o Building management and maintenance - o Cleaning products, janitorial and laundry services - o Construction materials and services (including concrete, insulation materials, etc.) - o Doors and windows - o Electricity acquisition and Renewable energy - o Food, catering services and vending machines - o Furniture - o Heating, venting and cooling products - o Landscaping and park services - o Lighting products and equipment (incl. lamp bulbs, indoor and outdoor lighting). - o Meeting and conference services - o Office electronics (incl. computers, monitors and imaging equipment) and electronic equipment leasing - o Office supplies (non-paper supplies) - o Paper and paper products - o Road Design, Construction and Maintenance - o Shipping, Packaging & Packing Supplies - o Textiles (including workwear) - o Transportation services and vehicles (including fleet maintenance) - o Urban Waste collection - o Waste water infrastructure - o Water-using products/ plumbing systems		
Social/Economic/Governance-related criteria		

Please choose from the proposed list below the issues considered in public procurement	Please add any details on the exact criteria which you may have considered when providing your answer, and which are referred to in contracts. E.g. Requiring a specific % of women in the workplace Promoting women-led businesses	
o Protecting against human rights abuses (for example, discrimination, unsafe working conditions child labour, forced labour, and human trafficking). It is advised to refer to the UN Guiding Principles for Business and Human Rights in the definition of such considerations. o Protecting and promoting groups at risk (for example, minorities, indigenous people, persons with disabilities, migrant workers) through social inclusion, which may include employment opportunities. o Promoting compliance with ILO standards and decent work o Promoting transparency and accountability and combatting corruption o Promoting SMEs o Promoting fair trade (for example, by ensuring fair living wages for those along the supply chain) o Promoting gender equality (for example, through the promotion of women-led businesses, or requiring a certain percentage of women in the workplace) o Promoting opportunities for social economy enterprises (NGOs, etc.) o Promoting Responsible Business Conduct among suppliers (governments may refer to the OECD Guidelines for Multinational Enterprises when defining these). o Promoting inclusive and equitable quality education, and lifelong learning opportunities for all (such as apprenticeship or training opportunities)		
Risk Assessment and Impact Prioritisation		
A risk-assessment analysis has been conducted to identify which product or service would show the highest environmental and / or social impact, and priority has been given to setting criteria for those categories first.	Yes, a risk assessment analysis has been conducted prior to the selection of categories	No, no risk assessment analysis has been conducted
Existence of a SPP Monitoring System		
Monitoring of SPP action plan/policy implementation		

Is the progress of your SPP action plan / policy implementation monitored? (If so, please provide specific details in column E)	Yes, progress of SPP Action plan/policy is monitored	No
Has a specific target been set for sustainable procurement implementation? (for example, specific % of "green", or socially-responsible contracts)	Yes, a specific target has been set	No
Is the progress towards the achievement of your target monitored?	Yes, target achievement is monitored	No
Monitoring of SPP implementation		
Is the number and/ or value of contracts which included sustainability requirements monitored? (If yes, please provide more details on the scope and data monitored, in column E)	Yes, # and / or value of 'sustainable' contracts is monitored	No
Does monitoring also entail the measurement of sustainability outcome(s) ? (such as the monitoring of reduction in CO2 emissions, or the creation of green jobs)	Yes, sustainability outcome(s) are monitored	No
How is data monitored? (Please choose the most suitable option) o Via surveys, self-assessment, or traditional reporting to management, OR ; o Via internal/external audit, OR ; o Via an information system, OR ; o Via an elaborate e-procurement platform.		No monitoring
Percentage of sustainable public procurement		
Procurement Categories		
	Please indicate the total value of contracts including sustainability requirements for the procurement of the procurement categories you listed in column B	Please provide details regarding what was considered as "sustainable" public procurement, and examples of tenders.
1. Your category here		
2. Your category here		
3. Your category here		
4. Your category here		

Appendix D – References and Sources

¹ Procurement Toolkit for Recycled Products and Materials, Sustainability Victoria: [Recycled Products and Materials - Procurement Toolkit for Recycled Products and Materials](#)

<https://greenroads.com.au/recycled-asphalt/>

<https://www.fhwa.dot.gov/publications/research/infrastructure/structures/97148/rap131.cfm>

https://www.downergroup.com/Content/cms/media/2020/Documents/The_Downer_bituminous_pavement_order_and_exemption_2020.pdf

<https://estatespaving.com/the-pros-and-cons-of-recycled-asphalt/>

<https://wearpartmanufactur.com/what-are-the-advantages-and-disadvantages-of-recycled-asphalt-concrete/>

<https://www.fhwa.dot.gov/pavement/sustainability/>

<https://www.co-asphalt.com/assets/docs/APASustainabilityBrochure.pdf>

<https://wastemanagementreview.com.au/sustainable-pavements-arrb/>

<https://www.nap.edu/read/22547/chapter/3#9>

<https://www.asphaltpavement.org/uploads/documents/EngineeringPubs/SIP101-Sustainability-Overview.pdf>

<https://www.fhwa.dot.gov/pavement/pubs/hif14015.pdf>

<https://www.calrecycle.ca.gov/tires/rac>

<https://www.arrb.com.au/news/traffic-test-for-crumb-rubber-asphalt-mixes>

<https://www.sciencedirect.com/topics/engineering/rubberized-concrete>

<https://www.calrecycle.ca.gov/Tires/RAC/Benefits/>

https://sustainability.ustires.org/wp-content/uploads/Rubber-Modified-Asphalt_COMP_hyperlinked.pdf

http://www.ucprc.ucdavis.edu/P-LCA2014/media/pdf/Papers/LCA14_Asphalt%20Rubber%20in%20China.pdf

<https://www.sciencedirect.com/science/article/pii/S2590198221001421?via%3Dihub>

<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8540435/>

<https://www.tyreandrubberrecycling.com/latest-news/posts/2019/april/rubberised-asphalt-in-australia/>

https://www.ardot.gov/wp-content/uploads/2020/11/TRC1101_Recycled_Asphalt_Shingles_in_Asphalt_Pavements_.pdf

<https://roadsonline.com.au/crumb-rubber-asphalt-putting-theory-into-practice/>

Kremer, P. D., & Symmons, M. A. (2015). Mass timber construction as an alternative to concrete and steel in the Australia building industry: a PESTEL evaluation of the potential. *International Wood Products Journal*, 6(3), 138-147.

Wood_Human_Health_final-single.pdf (nordic.ca)

Ding, G., & Thuy, N. (2020). Carbon Management: Forest Conservation and Management. In *Advances in Carbon Management Technologies* (pp. 40-58). CRC Press.

Smith, R. E., Griffin, G., Rice, T., & Hagehofer-Daniell, B. (2018). Mass timber: evaluating construction performance. *Architectural Engineering and Design Management*, 14(1-2), 127-138.

Evison, D. C., Kremer, P. D., & Guiver, J. (2018). Mass timber construction in Australia and New Zealand—Status, and economic and environmental influences on adoption. *Wood and Fiber Science*, 128-138.

Ainsworth Building, Macquarie University - YouTube

Salas, D. A., Ramirez, A. D., Ulloa, N., Baykara, H., & Boero, A. J. (2018). Life cycle assessment of geopolymer concrete. *Construction and Building Materials*, 190, 170-177.

Khan, M. S. H., & Kayali, O. (2018). Chloride binding ability and the onset corrosion threat on alkali-activated GGBFS and binary blend pastes. *European Journal of Environmental and Civil Engineering*, 22(8), 1023-1039.

Siddique, R., & Bennacer, R. (2012). Use of iron and steel industry by-product (GGBS) in cement paste and mortar. *Resources, Conservation and recycling*, 69, 29-34.

What are Properties of Low-carbon Steel - Definition | Material Properties (material-properties.org)

Ramunni, V. P., Coelho, T. D. P., & de Miranda, P. V. (2006). Interaction of hydrogen with the microstructure of low-carbon steel. *Materials Science and Engineering: A*, 435, 504-514.

Singh, R. (2020). *Applied welding engineering: processes, codes, and standards*. Butterworth-Heinemann.

Gómez-Soberón, J. M. (2002). Porosity of recycled concrete with substitution of recycled concrete aggregate: An experimental study. *Cement and concrete research*, 32(8), 1301-1311.

Park, W. J., Kim, T., Roh, S., & Kim, R. (2019). Analysis of life cycle environmental impact of recycled aggregate. *Applied Sciences*, 9(5), 1021.

Danielsen, S. W., & Kuznetsova, E. (2015). Environmental impact and sustainability in aggregate production and use. In *Engineering Geology for Society and Territory-Volume 5* (pp. 41-44). Springer, Cham.

Alqahtani, F. K. (2022). Technical Assessment of Green lightweight concrete containing manufactured plastic aggregates. *Journal of Building Engineering*, 50, 104169.

Lv, X., Lin, Y., Chen, X., Shi, Y., Liang, R., Wang, R., & Peng, Z. (2021). Environmental impact, durability performance, and interfacial transition zone of iron ore tailings utilized as dam concrete aggregates. *Journal of Cleaner Production*, 292, 126068.

<https://www.brickworks.com.au/wp-content/uploads/2020/07/AB-Bricks-CarbonNeutralBrochure-NAT.pdf>

<https://eliteagent.com/australias-first-certified-carbon-neutral-bricks/>