Fulton Hogan

Fulton Hogan Asphalt (Vic)

Environmental Product Declaration
In accordance with ISO 14025 and EN 15804

EPD Registration no. S-P-04650 | Version 1.0
Issued 24 February 2022 | Valid until 24 February 2027
Geographical Scope: Victoria, Australia

AUSTRALASIA EPD® ENVIRONMENTAL PRODUCT DECLARATION

ECO PLATFORM EPD VERIFIED

Contents

Program Information and Verification

An Environmental Product Declaration (EPD) is a standardised way of quantifying the potential environmental impacts of a product or system. EPDs are produced according to a consistent set of rules – Product Category Rules (PCR) – that define the requirements within a given product category. These rules are a key part of ISO 14025 as they enable transparency and comparability between EPDs. This EPD provides environmental indicators for Fulton Hogan asphalt products manufactured in Victoria, Australia. This EPD is a "cradle-to-gate" declaration covering production of asphalt including its supply chain.

This EPD is verified to be compliant with EN 15804. EPD of construction products may not be comparable if they do not comply with EN 15804. EPDs within the same product category but from different programs or utilising different PCRs may not be comparable. Fulton Hogan, as the EPD owner, has the sole ownership, liability and responsibility for the EPD.

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CEN standard EN 15804 served as the core PCR	
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PCR review was conducted by:	The Technical Committee of the International EPD® System. Chair: Claudia A. Peña. Contact via info@environdec.com
Independent verification of the declaration and data, according to ISO 14025:	☐ EPD process certification (Internal) ☑ EPD verification (External)
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Introduction

Fulton Hogan

Fulton Hogan is a family-owned business, committed to ensuring the work we do today will make a real difference to the lives of our people and customers, the communities they call home, and the world we live in, tomorrow.

In 1933, Jules Fulton and Bob Hogan teamed up to form Fulton Hogan. From there, we've grown to over 7000 people. A family of real people dedicated to doing good work that connects and cares for communities across New Zealand, Australia and the South Pacific.

From concrete, asphalt and aggregates through to biodiesel, signs and graphics, we've been supplying top quality construction products to the industry for over 50 years.

Fulton Hogan started on roads. In the last 88 years we've gained vast experience across a range of sectors, including roads and transport infrastructure through to utilities and resources.

We're all about keeping it REAL (Respect, Energy & effort, Attitude and Leadership). These are the values at the core of everything we do.

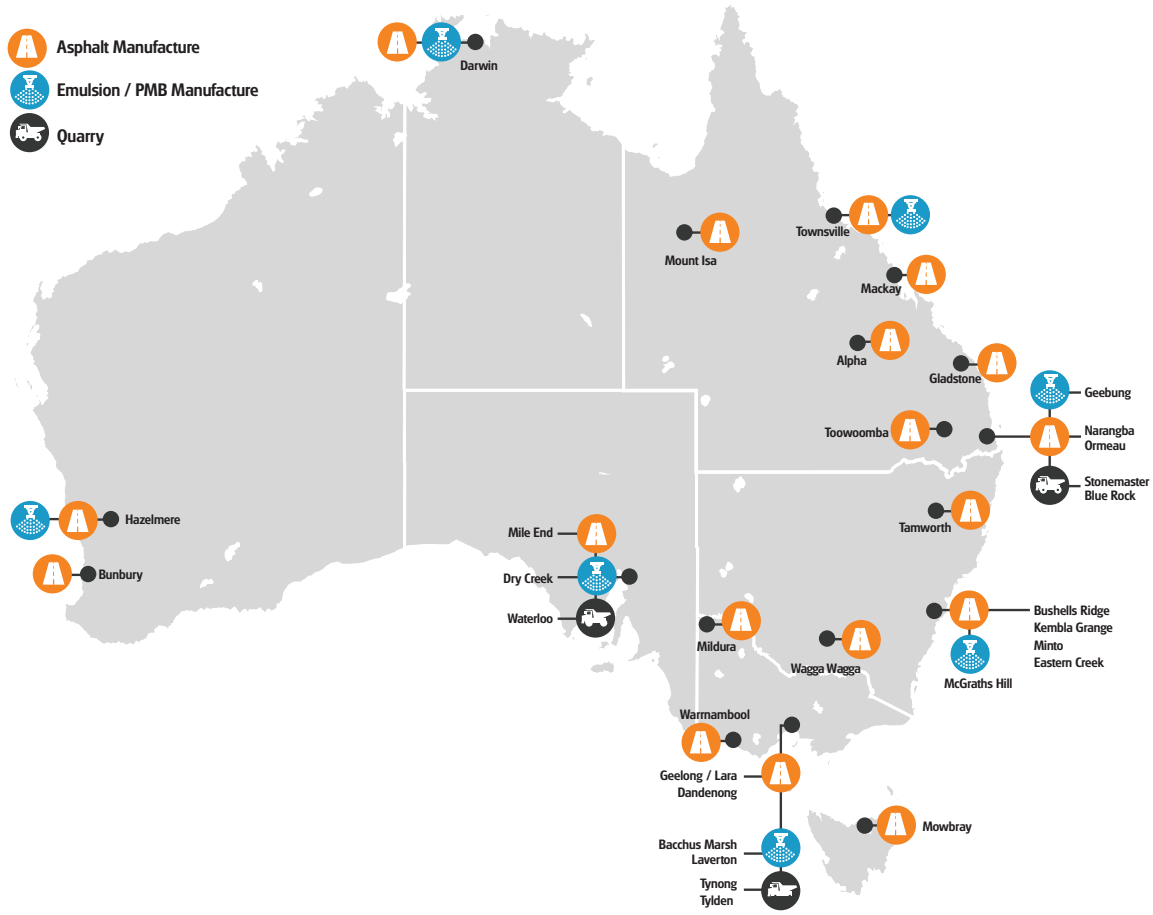
We see sustainability as the only way to do business. That's why we invest in the communities we work in, bridging gaps and creating economic value. It's our way of improving the world we'll live in tomorrow.

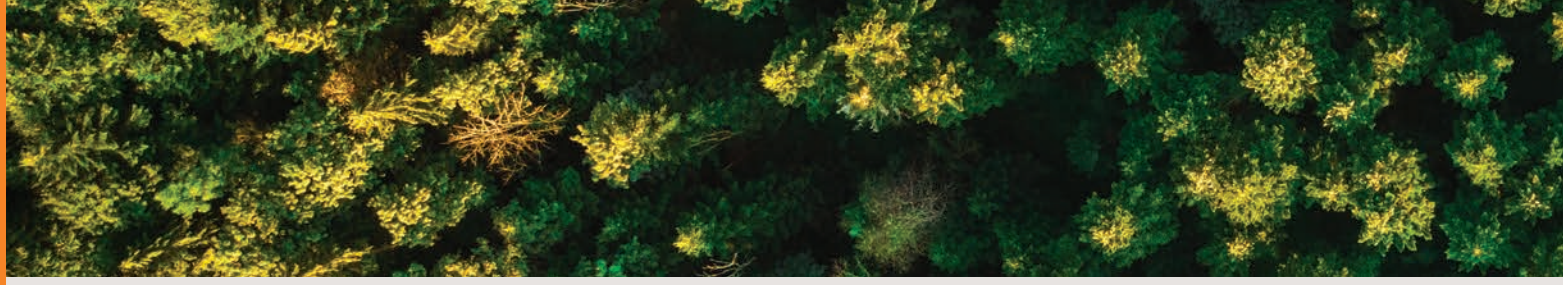
We care for the communities we operate in. Fulton Hogan and our people donate time, money and services to strengthen our communities. Through our partnerships we support wellbeing, diversity, environment, education and innovation.

Our decades of experience, combined with our wealth of plant and resources, give us the technical knowledge and skills to provide a wide range of construction services (including construction, surfacing, asset management, laboratories, transport and traffic management).

Fulton Hogan are industry leaders in the research and development of high-performance asphaltic concrete, emulsions, spray seal, and polymer modified binders. Our technical staff are some of the best in the business, developing innovative road building materials, to ensure better long term performance of our client's pavements. Senior members of our technical team work closely with clients in the civil construction and government sectors, to ensure that the products we develop, are not only relevant to their needs, but meet or exceed their stated technical, performance and environmental requirements. Our extensive experience in the structural design of pavements, has led to the development of a number of proprietary asphalt mix designs for motor racing circuits, airport runways, shipping container stacking yards, horse racing tracks, footpaths and residential roads.

Figure 1 - Fulton Hogan manufacturing and quarrying capabilities





Sustainability at Fulton Hogan

Sustainability in our industry means building and maintaining the critical infrastructure on which our nation depends. We do this in a manner that is cognisant of both the positive and negative impacts we may have on the community and the environment in the short and long term. In carrying out our duties, it is essential that we act with integrity and respect for the environment and communities in which we operate.

As a business our approach to sustainability focuses on the principles of **PEOPLE, PLANET, PROSPERITY** and **PARTNERSHIPS** that are aligned to the United Nation's Sustainable Development Goals. Using this framework, our locally empowered business operations are tasked with delivering positive contributions to the environment with solar installations that power our facilities or power purchase agreements to cap carbon emissions, as well as the community with traineeships, local sponsorships and partnerships.

Our product portfolio centres on developing and delivering quality, innovative products and services for our clients with the circular economy principles of waste utilisation, reuse, recycling and repurposing. These are front of mind when undertaking research and development which has led us to build an array of sustainable products. These include: high percentage recycled asphalt pavement using slag, glass and plastics, as well as crumb rubber asphalt and spray-seals.

We also commit to leaving a positive social impact for our people and communities by partnering with local business, increasing awareness of mental health, wellbeing and indigenous participation. Fulton Hogan's Infrastructure Services team, along with our clients and partners, are committed to taking tangible steps towards sustainability and making positive contributions to the communities in which we work, live and play now, so that future generations can benefit.

PEOPLE

Our People are at the heart of everything in Fulton Hogan. We understand the importance of hiring, developing and retaining great people who bring our REAL values to life every day. It is through maintaining a culture of safety, performance and growth that our people continue to do good work.

PROSPERITY

No company can succeed in a market where revenue doesn't equate to reasonable profits. Fulton Hogan has been in operation for over 85 years and has always taken the long term view of the business and its shareholders in to account. We re-invest heavily in research and development, plant, equipment and our people as we see this as the only way to remain truly sustainable.

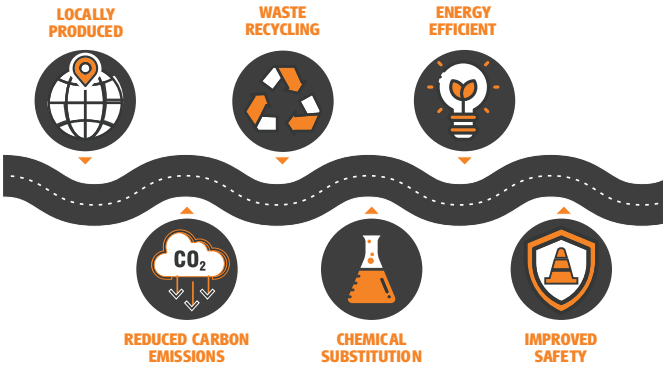
PLANET

Our operations can have an impact on the environment and communities in which we operate, we understand that. We also understand that it doesn't have to be a negative impact, that with intelligent planning and forethought we can contribute positively to the environment in which we operate and leave our world in a better place than when we started.

PARTNERSHIPS

We see and understand that a sustainable business is a stable business and is a key risk management strategy to our ongoing future performance. We cannot maintain our longevity nor succeed in our endeavours without the help and support of others along the way. Our good work philosophy rests with our people, their relationships, our clients and our partners as we strive to achieve shared value in the work that we do.

Figure 2 - Fulton Hogan sustainable product development roadmap



Fulton Hogan is committed to continuing the transition of construction and maintenance in the road sector from a linear to a circular economy by reusing, recycling, creating and circulating. This evolution is well advanced in with Reclaimed Asphalt Pavement (RAP), warm mix, crumb rubber, pavement recycling and glass sand being introduced and used by the sector over the last 30 years.

We understand that our roads are not linear rubbish tips; they are highly complex engineering structures and a key to economic development. Any sustainable product or process used in pavements must maintain the performance of the pavement, have a consistent quality and supply and must be cost competitive to current processes.

Most importantly, the product or process must not affect the sustainability of the world's most recycled product, asphalt.

Fulton Hogan offers the experience and expertise of its pavement engineers supported by our dedicated Research and Development team. The intellectual property they have created over the years has consistently benefited pavement owners.

As a technical leader in its field, Fulton Hogan takes pride in developing innovative solutions that provide environmental, financial and functional benefits to our customers. As our customers are seeking evermore sustainable cost effective and functional solutions, Fulton Hogan is continually looking at new products and processes to increase sustainability. Over the past 30 years, Fulton Hogan has used a high content of recycled pavements in their products, led the introduction of glass sand and wet blend crumb rubber asphalt, and has undertaken production and placement trials of asphalts produced with waste polymers, such as milk bottles, oil containers, plastic bags and drink bottles.

Our in-house design support benefits our clients by optimising both pavement, structural and material design ensuring material solutions meet both operational and sustainability goals.

Many consider Fulton Hogan's greatest strength to be our ability to work in a collaborative manner with our customers and communities. We focus on creating long-term trust-based partnerships that develop innovative sustainable solutions that can work in with operational considerations that often exceed the environmental, quality and performance expectations.

Fulton Hogan offers a number of sustainable solutions for our customers, which can both improve performance and reduce cost, helping our customer's transition to the circular economy. At Fulton Hogan, we can work with our customers to optimise sustainable solutions based on available materials, economic and functional needs.

In 2020, Fulton Hogan joined several prominent Melbourne businesses and Universities in the Melbourne Renewable Energy Project (MREP2) deal, which enables all of Fulton Hogan's Victorian asphalt plants, blending facilities, and quarries at Tylden and Tynong to be powered using renewable wind energy. More than 6,000 tonnes of carbon are removed from the environmental footprint of the products we manufacture, and the roads and infrastructure we build across the state.


P09
CAUTION
CAUTION
DANGER

Our Approach to this EPD

Fulton Hogan put people at the heart of everything. Development of this EPD has been a careful and considered process with the customer and community in mind. The EPD covers a comprehensive range of our asphalt products in key locations to provide our customers with the information they need without limiting choice. Taking a holistic approach to this the process has also provided Fulton Hogan with verified data on our products that will enable us to better understand our impacts on the environment and most importantly take effective action to reduce these impacts.

Fulton Hogan's Asphalt Products

Asphalt is one of the most used, reused and recycled pavement materials. This versatile material is used in several applications including to build roads, highways, airport runways, paths, parking lots and other projects where a smooth flat surface is required. Asphalt is a mix mainly composed of aggregates (crushed rock and sand) and bitumen (the black viscous sticky material) but sometimes special additives are also included to meet specific requirements.

Hot-mix asphalt is manufactured in a purpose-built plant where controlled amounts of aggregates of various size, previously blended and graded to meet a required specification, are dried and heated before being mixed with a measured quantity of hot bitumen in either a drum (large-output/continuous mixing plant) or in a pugmill (smaller-output/batch plant). Heat is used to remove moisture from the aggregate and to obtain sufficient fluidity of the bitumen to enhance mixing and workability.

Once the mixing is complete, the asphalt mix is then transported to the construction site and spread in a partially compacted layer to an even and uniform surface with a paving machine. While still hot, the paving mixture is further compacted by heavy rolling machines to produce a smooth pavement surface.

As part of Fulton Hogan's commitment towards a circular economy in the road construction sector, sustainable materials and practices are implemented during the asphalt manufacturing and laying process.

Fulton Hogan asphalt products incorporate a variety of sustainable materials including Reclaimed Asphalt Pavement (RAP), recycled glass, crumb rubber, and recycled plastics. RAP is a material generated from old, damaged pavement materials containing aggregates and bitumen; it is incorporated in asphalt mixes reducing the need to use virgin materials. Similarly, recycled materials and industry by-products such as recycled glass and slag aggregate (by-product of the steel making process) are used as replacement of natural quarry materials. Other recovered materials such as crumb rubber (from end-of-life tyres) and recycled plastics can be used as bitumen modifiers. These are blended through a wet process, achieving a high-quality binder with improved performance.

Sustainable practices such as the use of warm-mix asphalt and foam bitumen stabilisation are also implemented by Fulton Hogan. Warm-mix asphalt is produced at a reduced temperature allowing a significant reduction of emissions and energy used for production while maintaining the asphalt performance.

Some of our proprietary sustainable products are:

- TyrePhalt®
- PlastiPhalt®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ASTEC
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ASTEC

TyrePhalt®

Fulton Hogan has been working for more than two years to develop wet blended crumb rubber asphalt products under the TyrePhalt® banner. Available in 'open', 'gap' and 'dense graded' mixes, TyrePhalt's® applicability in different regions and for different purposes is growing. Crumb rubber modified bitumen used as a binder for asphalt mixes for community roads is a tangible contribution to the environment through recycling used tyres, and a lower life-cycle cost of the resulting road pavement. Although it has been used elsewhere in the world, Fulton Hogan has demonstrated conclusively its recyclability and value in asphalt in Australia and that, when designed carefully, the mix becomes a high performing durable product, with improved engineering properties. Adding Crumb Rubber to the binder can further enhance the durability and long-term performance of asphalt, providing improved flexibility, increased resilience, toughness and fatigue resistance.

More than 56 million tyres (450,000 tonnes) reach their end-of-life in Australia each year. The majority of these end up in landfills. To produce crumb rubber pavement materials, tyres from various sources, including heavy and light vehicles, are granulated and processed to a specific particle size of approximately 1mm and blended with bitumen at a rate of approximately 12% to 20% by mass of the bitumen. The rubber modified binder is used for the manufacture of hot and warm mix asphalt, as well as spray seals. On average, 19 standard tyres are saved from landfill for every one tonne of rubber modified binder manufactured.

Benefits:

- Reducing the number of end-of-life tyres to landfill
- Increase binder viscosity and film thickness on aggregate
- Improved fatigue resistance (crack resistance)
- Excellent adhesion properties when used in surface seals
- Improved elastomeric properties

PlastiPhalt®

PlastiPhalt® is an innovative asphalt pavement containing recycled waste plastic. Unlike other asphalts modified with recycled Plastics, PlastiPhalt® uses a specially selected polymer which is fully incorporated into the binder to make a true polymer modified binder (PMB). Fulton Hogan has undertaken extensive research to ensure PlastiPhalt® conforms to Austroads AG:PT T-190 PMB framework.

As a result, PlastiPhalt® can be designed and manufactured as an A35P equivalent binder. A specialty selected waste plastic stream has been selected to be used in the product's production. PlastiPhalt® has been designed to achieve a durable, long-term asphalt pavement, whilst providing the benefits of reusing a waste stream that would otherwise go to landfill. Fulton Hogan is committed to the quality of our asphalt.

PlastiPhalt® is a high-quality product that can also be tested to client nominated requirements to ensure consistency and quality of the asphalt is maintained. Fulton Hogan's laboratories can provide NATA-accredited test reports upon supply of PlastiPhalt®.

Benefits:

- PlastiPhalt® diverts plastic waste from landfill from a local supply
- Improved rut resistance
- Improved fatigue performance and stability
- Extended asphalt surface life

Declared Asphalt Products

This EPD covers a range of key asphalt products manufactured at two Victorian asphalt facilities: Dandenong asphalt plant in the south-east of Melbourne and Lara asphalt plant in the west, as seen in Figure 3. Over 90 asphalt products from both plants are declared in this EPD, the complete list is presented in Table 2.

Figure 3 - Location of Fulton Hogan's asphalt production facilities as included in the EPD

Product Composition

The main components in asphalt mixes are bitumen and aggregates. Other materials such as mineral fillers and fibres can be added and their content varies depending on the asphalt type. Reclaimed Asphalt Pavement (RAP) is also commonly incorporated into asphalt mixes to replace virgin bitumen and virgin aggregate. The content declaration of the asphalt products declared in this EPD is shown in Table 1.

Table 1: Product composition

Raw material	Asphalt mix composition (Weight %)
Bitumen, virgin	3 - 7
Bitumen modifiers (crumb rubber*, SBS, EVA, recycled plastic*)	0 - 1.5
Reclaimed Asphalt Pavement (RAP)**	0 - 40
Fine aggregates (natural /manufactured sand/recycled glass*)	5 - 30
Coarse aggregates (crushed rock)	30 - 90
Mineral fillers	0 - 9.5
Anti-strip agents	0 - 1.5
Fibre	0 - 0.5

* post-consumer recycled material; ** 95% post-consumer recycled material & 5% production waste

The products included in this EPD do not contain any substances of very high concern as defined by European REACH regulation in concentrations >0.1% (m/m).

Table 2: List of asphalt products declared in this EPD

Specification / Standard	Dandenong	Lara
DoT - Section 407 Dense Graded Asphalt (DGA)	Size 7mm DGA Type H Size 7mm DGA Type L Size 7mm DGA Type N Size 10mm DGA Type H Size 10mm DGA Type H 10% RAP Size 10mm DGA Type H 20% RAP Size 10mm DGA Type HP Size 10mm DGA Type L Size 10mm DGA Type L 10% RAP Size 10mm DGA Type L 20% RAP Size 10mm DGA Type N Size 10mm DGA Type N 10% RAP Size 10mm DGA Type N 20% RAP Size 10mm DGA Type V Size 14mm DGA Type H Size 14mm DGA Type H 10% RAP Size 14mm DGA Type H 20% RAP Size 14mm DGA Type HP Size 14mm DGA Type N Size 14mm DGA Type N 10% RAP Size 14mm DGA Type N 20% RAP Size 14mm DGA Type SI Size 14mm DGA Type SI 10% RAP Size 14mm DGA Type SI 20% RAP Size 14mm DGA Type V Size 14mm DGA Type VP Size 20mm DGA Type SI Size 20mm DGA Type SI 20% RAP Size 20mm DGA Type SI Glass 20% RAP Size 20mm DGA Type SI 30% RAP Size 20mm DGA Type SF Size 20mm DGA Type SF 20% RAP Size 20mm DGA Type SF Glass 20% RAP Size 20mm DGA Type SF 30% RAP Size 20mm DGA Type SF 40% RAP Size 20mm DGA VR407 SS Size 20mm DGA VR407 SS 30% RAP	Size 7mm DGA Type H Size 7mm DGA Type L Size 7mm DGA Type N Size 10mm DGA Type H Size 10mm DGA Type H 10% RAP Size 10mm DGA Type HP Size 10mm DGA Type L Size 10mm DGA Type L 10% RAP Size 10mm DGA Type N Size 10mm DGA Type N 10% RAP Size 10mm DGA Type N Glass 10% RAP Size 10mm DGA Type V Size 14mm DGA Type H Size 14mm DGA Type H 10% RAP Size 14mm DGA Type HP Size 14mm DGA Type N Size 14mm DGA Type N 10% RAP Size 14mm DGA Type SI Size 14mm DGA Type SI 10% RAP Size 14mm DGA Type V Size 20mm DGA Type SI Size 20mm DGA Type SI 10% RAP Size 20mm DGA Type SI 20% RAP Size 20mm DGA Type SF Size 20mm DGA Type SF 10% RAP Size 20mm DGA Type SF 20% RAP Size 20mm DGA Type SF Glass 20% RAP Size 20mm DGA Type SS
DoT - Section 404 Stone Mastic Asphalt (SMA)	Size 10mm SMA Type H Size 10mm SMA Type N	Size 10mm SMA Type H Size 10mm SMA Type N
DoT - Section 405 Regulation Gap Graded Asphalt (RGG)	Size 7mm RGG	
DoT - Section 417 Open Graded Asphalt (OGA)	Size 10mm OGA (A10E) Size 10mm OGA (A20E)	Size 10mm OGA (A20E)
DoT - Section 422 Light Traffic Crumb Rubber Asphalt (LTCRA)	Size 10mm LTCRA (TyrePhalt®) Size 10mm LTCRA 10% RAP (TyrePhalt®) Size 14mm LTCRA 15% RAP (TyrePhalt®)	Size 10mm LTCRA (TyrePhalt®) Size 10mm LTCRA 10% RAP (TyrePhalt®)
AS2150	Size 7mm SMA Type H Size 7mm DGA Fine Size 10mm DGA Fine Size 14mm Gap-Graded Crumb Rubber (GG CR)	Size 10mm LTCRA Glass 10% RAP
Proprietary	Size 10mm PlastiPhalt® 20% RAP Size 14mm PlastiPhalt® 20% RAP Size 14mm Portphalt DR Size 20mm Portphalt DR	Size 10mm PlastiPhalt® 10% RAP Size 14mm PlastiPhalt® 10% RAP

Technical Compliance

Fulton Hogan asphalt mixes are designed in accordance with the following Australian standards and state road authority-based specifications:

- AS 2150 Asphalt - A guide to good practice
- AS/NZS 2891 Methods of sampling and testing asphalt
- DoT Section 404 Stone Mastic Asphalt
- DoT Section 405 Regulation Gap Graded Asphalt
- DoT Section 407 Dense Graded Asphalt
- DoT Section 417 Open Graded Asphalt
- DoT Section 422 Light Traffic Crumb Rubber Asphalt

Product Identification

The product code for asphalt is UN CPC 1533 (Bitumen and asphalt, natural; asphaltites and asphaltic rock) & 3794 (Bituminous mixtures based on natural and artificial stone materials and bitumen, natural asphalt or related substances as a binder) and ANZSIC Class 1709 (Other Petroleum and Coal Product Manufacturing).

Scope of Environmental Product Declaration

This EPD covers the cradle-to-gate life cycle stages A1-A3. Downstream stages have not been included.

Table 3: Scope of EPD

Product Stage			Construction Stage		Use Stage							End-of-life Stage				Benefits beyond system boundary
Raw Materials	Transport	Production	Transport	Installation	Use	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	Deconstruction/Demolition	Transport	Waste Processing	Disposal	Reuse, recovery, recycling potential
A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
			Scenario		Scenario							Scenario				
✓	✓	✓	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND

✓= module is included in this study
MND = module is not declared

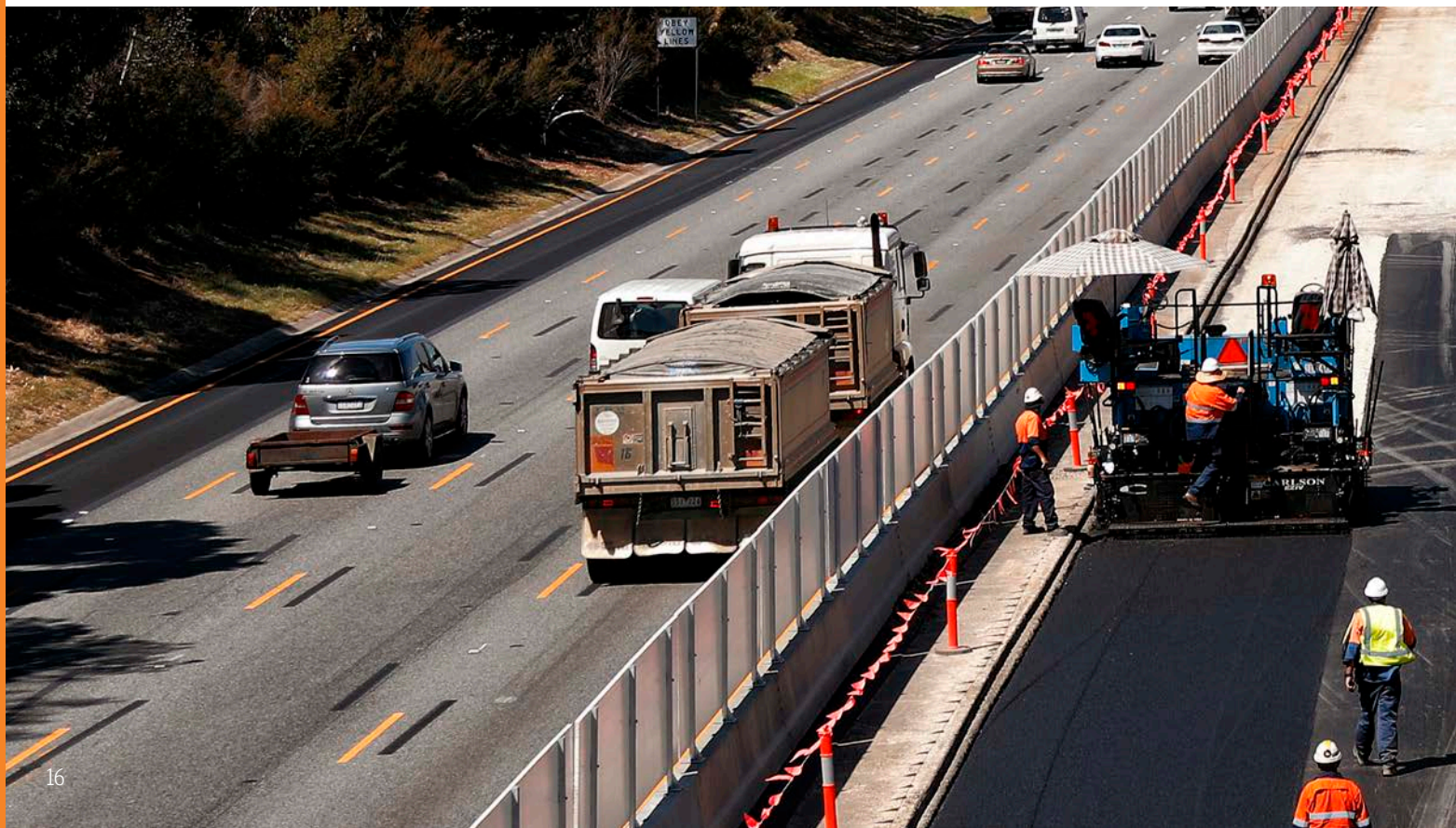
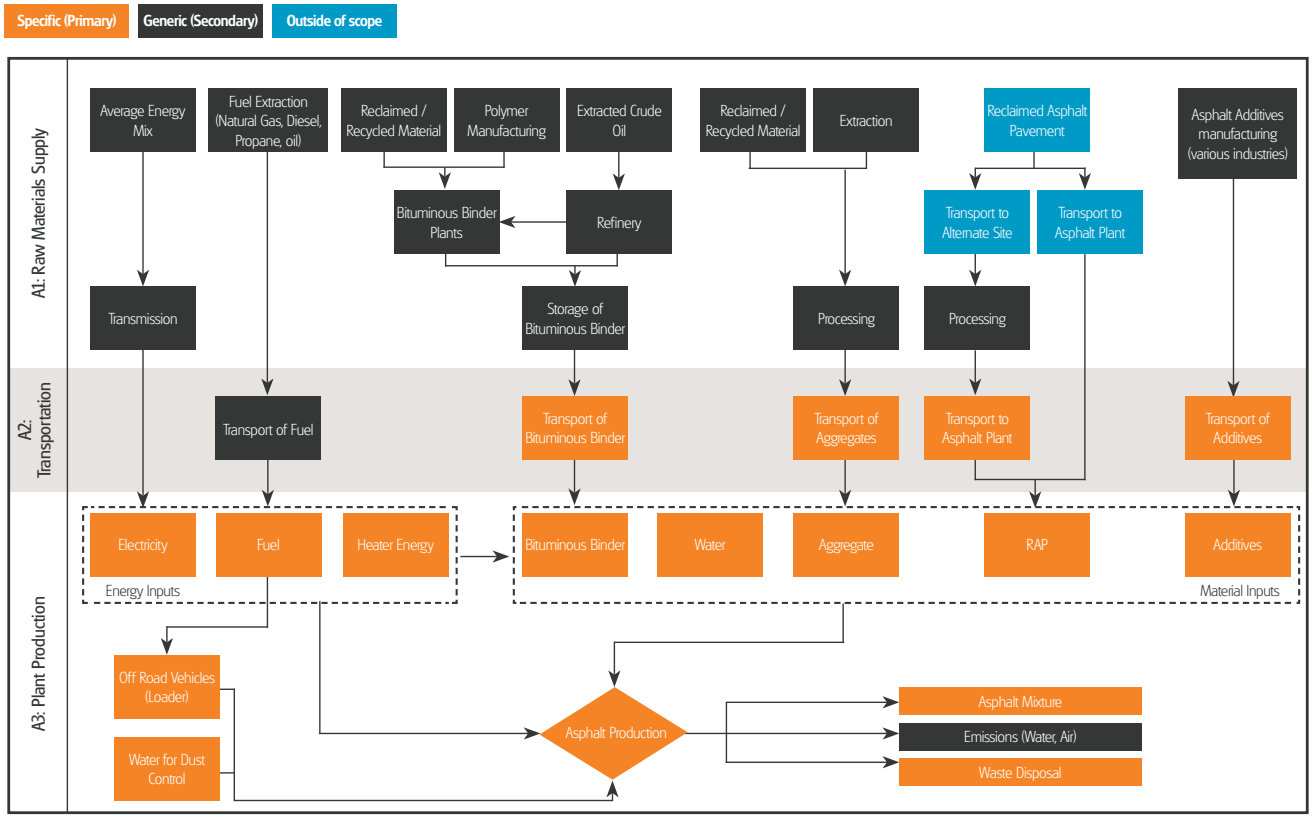


Figure 4: Cradle-to-gate life cycle of asphalt products (AEPDP 2019)



Cradle-to-gate Life Cycle Stages

Raw Material Stage A1

Typically, asphalt is manufactured by blending a selection of the materials shown in Table 1 in proportions determined during the design process.

Bitumen

Bitumen acts as the binder or glue that holds the other materials together. It is a product of the crude oil refining process, which typically takes place overseas before being imported to Australia. In Victoria, Fulton Hogan sources locally refined bitumen majority of the time. Bitumen needs to be stored at temperatures around 165°C in order to make it possible to use in asphalt. Bitumen is available in different classes or grades and typically needs to conform to AS 2008 Bitumen for Pavements or ATS 3110 Supply of Polymer Modified Binders

Bitumen Modifiers

Bitumen may be modified by blending it with a synthetic polymer creating what is commonly known as a Polymer Modified Binder or PMB. Different types of polymers are used in PMBs but most common ones are Styrene-Butadiene-Styrene (SBS) which provides improved resilience and makes the binder less susceptible to temperature, and Ethylene-Vinyl Acetate (EVA) to provide increased stiffness. Post-consumer recycled plastics are also used in Fulton Hogan's PlastiBind ® PMB. Synthetic polymers are typically manufactured overseas in countries such as Germany and South Korea prior to being imported to Australia. PMBs are blended at Fulton Hogan's facility in Laverton Victoria before being transported to the asphalt plant.

Coarse and Fine Aggregates (including sand)

Coarse and fine aggregates generally make up the bulk of the asphalt mixture and provide the finished asphalt pavement with structure and strength. Aggregates are natural materials typically extracted from quarries before going through processes such as crushing, screening and washing for use in asphalt. The source for asphalt aggregates is typically as close to the asphalt plant as possible provided the finished aggregate product complies with DoT Section 801 Material sources for the production of crushed rock and aggregates.

Recycled Materials

Fulton Hogan is embracing and accelerating the circularity of materials for incorporating into asphalt without compromising on quality.

Reclaimed Asphalt Pavement (RAP) consists of existing asphalt pavements that have been removed by milling (profiling) before being processed according to strict internal management standards. Incorporating RAP in asphalt replaces a proportion of the aggregates as well as allowing for a reduction in bitumen content.

Recovered Glass Sand is generated by the crushing and washing of used glass containers to a grading that is similar to that of natural sand. Recovered Glass Sand is used to replace a proportion of natural sand in asphalt mixes.

Crumb Rubber is generated from shredding and grinding end-of life tyres at dedicated recycling facilities located across Australia. Adding crumb rubber to asphalt binders improves performance and is used to produce asphalt that complies with DoT Section 422 Light Traffic Crumb Rubber Asphalt.

Mineral fillers

Mineral fillers used in asphalt include hydrated lime and fine ground limestone. Filler performs various roles in asphalt from stiffening the bitumen to providing enhanced adhesion properties. The properties of fillers are required to meet the requirements of DoT Section 407 Dense Graded Asphalt.

Additives

Common additives used in asphalt include warm mix additives, adhesion agents, oxides and cellulose fibres. Additives enhance asphalt's structural and/or functional properties such as workability, stiffness, colour, binder retention and adhesion.

Transportation Stage A2

Delivery of raw materials to Fulton Hogan asphalt plants is via road transport in varying truck and trailer combinations including semi-trailers, and tankers in the case of hydrated lime and bitumen. Whilst all efforts are made to source raw materials close to the asphalt plant to minimise transportation impacts, not all materials are locally available. Materials such as bitumen, polymer modifiers, and other additives need to be imported and include additional shipping and road transportation prior to delivery to site. The impact of each mode of transportation is determined by taking into account the specific supply source for each plant and its location.

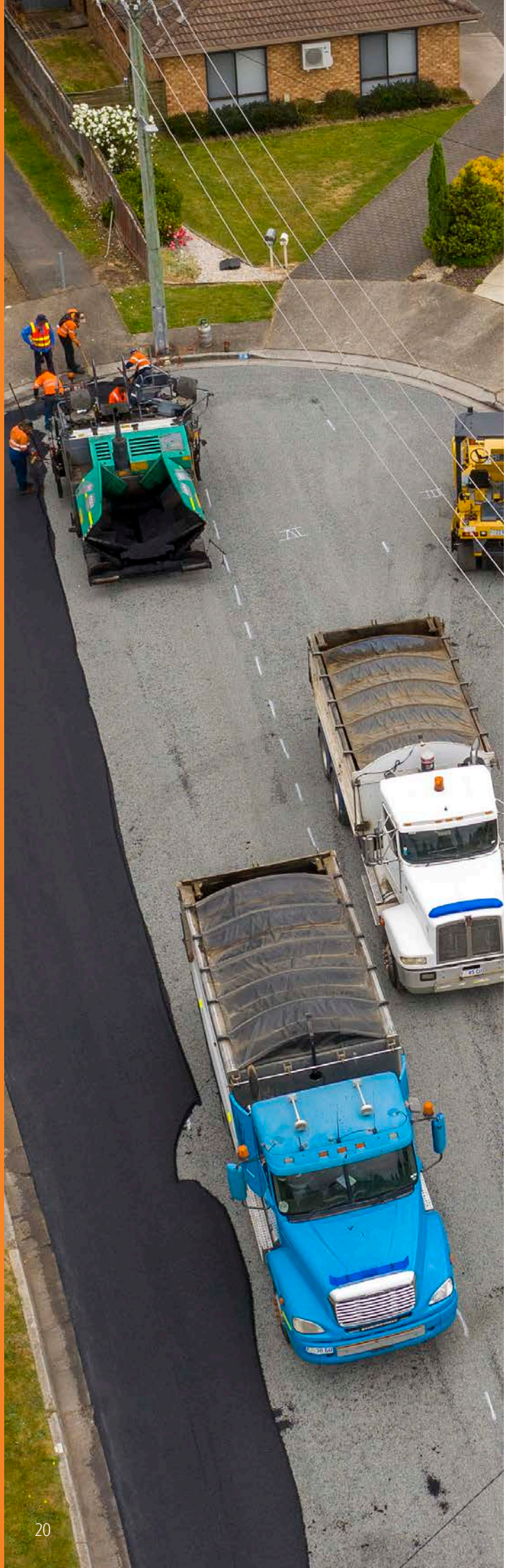
Manufacturing Stage A3

The asphalt manufacturing process as described in the section "Fulton Hogan Asphalt Products" (p. 9) requires energy inputs in the form of electricity and fuels.

Electricity provides mechanical, light and heat energy required to operate the asphalt plant and store raw materials. In 2020, Fulton Hogan joined the Melbourne Renewable Energy Project (MREP2) deal, which enables all of Fulton Hogan's Victorian asphalt plants, blending facilities, and quarries at Tylden and Tynong to be powered using renewable wind energy. The specific source of electricity (wind) is reflected in the LCA.

Fuels are used to heat and dry the sand and aggregates and are typically diesel, natural gas, or Liquefied Petroleum Gas (LPG). Fuel is also required for mobile plant on site, such as front-end loaders, which are typically used to feed aggregates into the asphalt plant.

This manufacturing stage covers the blending of materials at the asphalt plant and does not capture delivery or placement of asphalt.



Life Cycle Assessment (LCA) Methodology

Background Data

Fulton Hogan has collected and supplied the primary data for the LCA. In Victoria, the primary data covers the operation of two asphalt production sites (Dandenong and Lara). Background data (e.g. for energy and transport processes, bitumen and other raw materials) have predominantly been sourced from AusLCI and the AusLCI shadow database (v1.36), in line with the Australian PCR Appendix for asphalt mixtures (AEPDP 2019).

The prescribed Life Cycle Inventory (LCI) data for bitumen and rubber crumb have a significant effect on the results of the LCA. When comparing asphalt EPDs, it is therefore important to understand which background LCI data are used.

The asphalt production data has been collected for FY20 (1 July 2019 – 30 June 2020). Environmental profiles of our products are based on life cycle data that are less than five years old. Background data used are less than 10 years old or have been reviewed within this period.

Methodological choices have been applied in line with PCR 2018:04 Asphalt Mixtures (Environdec 2019) and the Australian Appendix to the Product Category Rules for Asphalt (AEPDP 2019), which also aligns with EN 15804; deviations have been recorded.

Fulton Hogan's Victorian sites participate in MREP2, a renewable electricity Power Purchase Agreement (PPA). In line with the PCR, we have modelled the contracted electricity using the specific electricity mix from the electricity supplier as documented by Renewable Energy Certificates (RECs) or Guarantees of Origin. In this case, Fulton Hogan is supplied with wind power for which we have used ecoinvent 3 data for onshore wind power. This electricity dataset has a greenhouse gas intensity of 0.002 kg CO_2e/kWh.

Allocation

The key processes that require allocation are:

- **Asphalt production:** Fulton Hogan manufactures a range of asphalt products at its sites. Products can be produced at different temperatures (e.g. hot mix, warm mix or cold mix) and the composition of the asphalt mix also affects the amount of energy required to drive off moisture and heat up the raw materials to the required temperature. To determine the energy requirements for each mix design, start2see has applied Method A (AEPDP 2019; section 2.5): Determine the energy use for each mix design based on the composition, specific heat capacity of components, moisture content of raw materials and the plant's overall efficiency.
- **RAP:** Reclaimed Asphalt Pavement (RAP) reaches the end-of-waste state when the reclaimed, milled material has been collected in a truck and transported to a storage pile, ready to be processed for further use. Fulton Hogan typically receives and processes RAP at its asphalt plants. Any energy use for RAP processing is covered by the energy data for the asphalt plant. The main asphalt PCR (Environdec 2019) and ISO 14021 state that recycled content of products should only cover recycled materials from pre-consumer (post-industrial) and post-consumer scraps, but not recycled material made from internal scrap. Fulton Hogan has indicated that around 5% of RAP used in Victoria originates from production waste. Therefore, each 1.0 kg of RAP used in Fulton Hogan's asphalt amounts to 0.95 kg of Secondary Material (parameter: SM).
- **Aggregates:** aggregates are produced through crushing of rock, which is graded in different sizes. The energy required for the crushing and screening does not differentiate between products. Therefore, aggregate production (including manufactured sand) has been allocated based on the mass of product.
- **Slag aggregates:** Steel furnace slag is a co-product from steel production. Economic allocation is used to attribute a portion of the steel furnace process to the slag as per AusLCI data.
- **Crumb rubber:** End-of-life tyres reach the end-of-waste state after they have been collected and shredded into tyre-derived-fuel (TDF). Further processing of this rubber can involve grinding the material into crumb rubber, a fine powder. The energy required for the grinding process is attributed to the crumb rubber.

Cut-off Criteria

The cut-off criteria applied are 1% of renewable and non-renewable primary energy usage and 1% of the total mass input of a process

- The contribution of capital goods (production equipment and infrastructure) and personnel is outside the scope of the LCA, in line with the PCR (Environdec 2019).
- Crumb rubber (reusable bulk-bags) and additives used in minor quantities are supplied in packaged format. As the packaging used for these products is well below the materiality cut-off and is often recyclable or reusable, the packaging materials have been omitted from the analysis. The impact on the footprint of asphalt products is negligible.
- Greases, lubricants and other minor ancillary materials used during asphalt production have been excluded. The impact on the footprint of asphalt products is negligible.

Key Assumptions

The key assumptions in the LCA are:

- **Asphalt composition:** The asphalt composition of each product is taken from Fulton Hogan's systems. These data are considered to be of high accuracy.
- **Site energy data:** When calculating the environmental performance of individual asphalt products, the burner energy used for heating raw materials to the asphalt's production temperature is calculated for each individual product. The PCR Appendix (AEPDP 2019) refers to this as Method A.
- **Other site-related impacts** (site electricity use, fuel use for equipment and water use) have been attributed to asphalt products based on their respective production volumes (in tonnes). This approach assumes that the impacts are similar per tonne of asphalt product. Mass allocation is considered the most reasonable approach to attributing generic site environmental impacts across different products.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Life Cycle Assessment (LCA) Results

The background LCA serves as the foundation for this EPD. An LCA analyses the environmental processes in the value chain of a product. It provides a comprehensive evaluation of all upstream (and sometimes downstream) material and energy inputs and outputs. The results are provided for a range of environmental impact categories, in line with EN 15804.

Declared Unit

The declared unit applied to all of the products is:

1 metric tonne (t) of manufactured asphalt mixture (as ordered by client) with identifying characteristics.

This declared unit has been selected in line with the Australian PCR Appendix (AEPDP 2019).

Explanation of Averages

Some products with minor variations in mix designs have been grouped for presentation in this EPD. No products have been grouped across plants.

When grouping has been applied, an unweighted average across the products is used as the representative product. From the table headers in the result section (Environmental Profiles), it can be easily deducted which products are presented as a single product and which products are included as a group. For example, Table 14 shows the results for "Size 7, 10mm SMA Type H/N". This group covers 7mm SMA products and 10mm SMA products that meet Type H and Type N classification. Table 2 shows which individual products meet these criteria (Size 10mm SMA Type H; Size 10mm SMA Type N; Size 7mm SMA Type H).

The environmental profiles of the products that are grouped together have been checked to ensure they stay within ±10% of the representative product. In all groups, the carbon footprint of the products that have been grouped stays withing ±5% of the carbon footprint of the representative product of that group. Sporadically (less than 2% of the results), a product within a group falls outside the ±10% range on one or more of the other environmental indicators. The maximum variation witnessed is ±13%.

Environmental Indicators

The environmental indicators presented in this EPD are in line with EN 15804:2012+A1:2013.

Table 4: Environmental indicators

Environmental Indicator	Acronym	Unit	Description
Global Warming Potential	GWP	kg CO_2 eq	Global warming impact of greenhouse gases such as carbon dioxide (CO_2), measured in kg CO_2 equivalents using a global warming potential over a 100-year time horizon. As per PCR 2018:04, a breakdown into fossil, biogenic, and land use and land use change GWP results is provided.
Ozone Depletion Potential	ODP	kg CFC-11 eq	Relative impact that the product can cause to the stratospheric ozone layer, measured in kg trichlorofluoromethane (CFC-11) equivalents.
Acidification Potential	AP	kg SO_2 eq	Increase of soil and water acidity that the product can cause, measured in kg sulphur dioxide (SO_2) equivalents.
Eutrophication Potential	EP	kg PO_4^{3-} eq	Potential impact of nutrification by nitrogen and phosphorus to aquatic and terrestrial ecosystems, for example through algal blooms, measured in kg phosphate (PO_4^{3-}) equivalents.
Photochemical Ozone Creation Potential	POCP	kg C_2H_4 eq	Also known as summer smog, the potential impact from oxidising of volatile compounds in the presence of nitrogen oxides (NOx) which frees ozone in the low atmosphere, measured in kg ethene (C_2H_4) equivalents.
Abiotic Depletion Potential (elements)	ADPE	kg Sb eq	Economic impact from the depletion of scarce non-renewable resources such as metals, measured in kg antimony equivalents.
Abiotic Depletion Potential (Fossil Fuels)	ADPF	MJ	Economic impact from depletion of fossil fuel resources such as oil or natural gas, expressed using their net calorific value.

Table 5: Parameters describing resource use, waste and output flows

Parameter	Acronym	Unit
Parameters describing resource use		
Use of renewable primary energy excluding renewable primary energy resources used as raw materials	PERE	MJ_{NCV}
Use of renewable primary energy resources used as raw materials	PERM	MJ_{NCV}
Total use of renewable primary energy resources	PERT	MJ_{NCV}
Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials	PENRE	MJ_{NCV}
Use of non-renewable primary energy resources used as raw materials	PENRM	MJ_{NCV}
Total use of non-renewable primary energy resources	PENRT	MJ_{NCV}
Use of secondary material	SM	kg
Use of renewable secondary fuels	RSF	MJ_{NCV}
Use of non-renewable secondary fuels	NRSF	MJ_{NCV}
Use of net fresh water	FW	m^3
Waste categories		
Hazardous waste disposed	HWD	kg
Non-hazardous waste disposed	NHWD	kg
Radioactive waste disposed	RWD	kg
Output flows		
Components for re-use	CRU	kg
Materials for recycling	MFR	kg
Materials for energy recovery	MER	kg
Exported energy	EE	MJ

Environmental Profiles for Asphalt Products at Dandenong

The cradle-to-gate (module A1-A3) environmental profiles and environmental parameters of each product (group) are expressed per tonne of asphalt (volume as ordered by the client).

Table 6: Environmental profiles of asphalt products manufactured at Dandenong, stages A1-A3, per tonne

	Product	Size 7, 10, 14mm DGA Type H	Size 10mm DGA Type H 10-20% RAP	Size 14mm DGA Type H 10-20% RAP	Size 7, 10mm DGA Type L	Size 10mm DGA Type L 10-20% RAP
	Standard	DoT - Section 407 Dense Graded Asphalt (DGA)				
Indicator	Unit					
Global warming (total)	kg CO_2 eq	64.8	63.5	60.5	61.8	56.1
GWP-fossil	kg CO_2 eq	64.8	63.4	60.5	61.8	56.1
GWP-biogenic	kg CO_2 eq	0.0206	0.0187	0.0173	0.0214	0.0186
GWP-land use	kg CO_2 eq	2.11E-04	1.75E-04	1.71E-04	2.21E-04	1.77E-04
Ozone layer depletion	kg CFC11 eq	2.79E-05	2.48E-05	2.24E-05	3.01E-05	2.56E-05
Acidification, soil and water	kg SO_2 eq	0.363	0.327	0.299	0.386	0.332
Eutrophication	kg PO_4^{3-}eq	0.0239	0.0226	0.0211	0.0241	0.0214
Photochemical ozone creation	kg C_2H_4 eq	0.0582	0.0533	0.0490	0.0606	0.0523
Abiotic depletion - elements	kg Sb eq	3.00E-07	2.86E-07	2.59E-07	3.13E-07	2.94E-07
Abiotic depletion - fossil	MJ_{NCV}	3330	2990	2730	3570	3100

Table 7: Environmental parameters of asphalt products manufactured at Dandenong, stages A1-A3, per tonne

	Product	Size 7, 10, 14mm DGA Type H	Size 10mm DGA Type H 10-20% RAP	Size 14mm DGA Type H 10-20% RAP	Size 7, 10mm DGA Type L	Size 10mm DGA Type L 10-20% RAP
	Standard	DoT - Section 407 Dense Graded Asphalt (DGA)				
Parameter	Unit					
PERE	MJ_{NCV}	2.95E+01	2.84E+01	2.82E+01	2.91E+01	2.72E+01
PERM	MJ_{NCV}	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PERT	MJ_{NCV}	2.95E+01	2.84E+01	2.82E+01	2.91E+01	2.72E+01
PENRE	MJ_{NCV}	7.10E+02	6.89E+02	6.63E+02	6.92E+02	6.39E+02
PENRM	MJ_{NCV}	2.88E+03	2.53E+03	2.27E+03	3.16E+03	2.70E+03
PENRT	MJ_{NCV}	3.59E+03	3.22E+03	2.93E+03	3.85E+03	3.34E+03
SM	kg	0.00E+00	1.35E+02	1.32E+02	0.00E+00	1.35E+02
RSF	MJ_{NCV}	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NRSF	MJ_{NCV}	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
FW	m^3	6.98E-01	6.98E-01	6.26E-01	7.17E-01	7.12E-01
HWD	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NHWD	kg	3.12E-02	2.92E-02	2.64E-02	3.24E-02	2.89E-02
RWD	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
CRU	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
MFR	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
MER	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
EE	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Table 8: Environmental profiles of asphalt products manufactured at Dandenong, stages A1-A3, per tonne

	Product	Size 7, 10, 14mm DGA Type N	Size 10mm DGA Type N 10-20% RAP	Size 14mm DGA Type N 10-20% RAP	Size 10, 14mm DGA Type HP	Size 10, 14mm DGA Type V
	Standard	DoT - Section 407 Dense Graded Asphalt (DGA)				
Indicator	Unit					
Global warming (total)	kg CO_2 eq	62.1	73.2	59.0	80.1	61.2
GWP-fossil	kg CO_2 eq	62.1	73.2	59.0	80.0	61.2
GWP-biogenic	kg CO_2 eq	0.0203	0.0491	0.0164	0.0823	0.0191
GWP-land use	kg CO_2 eq	2.11E-04	2.42E-04	1.62E-04	2.96E-04	2.02E-04
Ozone layer depletion	kg CFC11 eq	2.77E-05	2.57E-05	2.12E-05	2.67E-05	2.53E-05
Acidification, soil and water	kg SO_2 eq	0.360	0.373	0.285	0.423	0.334
Eutrophication	kg PO_4^{3-}eq	0.0234	0.0251	0.0204	0.0276	0.0226
Photochemical ozone creation	kg C_2H_4 eq	0.0571	0.0613	0.0469	0.0694	0.0535
Abiotic depletion - elements	kg Sb eq	2.99E-07	5.17E-07	2.44E-07	7.72E-07	2.84E-07
Abiotic depletion - fossil	MJ_{NCV}	3310	3250	2600	3560	3060

Table 9: Environmental parameters of asphalt products manufactured at Dandenong, stages A1-A3, per tonne

	Product	Size 7, 10, 14mm DGA Type N	Size 10mm DGA Type N 10-20% RAP	Size 14mm DGA Type N 10-20% RAP	Size 10, 14mm DGA Type HP	Size 10, 14mm DGA Type V
	Standard	DoT - Section 407 Dense Graded Asphalt (DGA)				
Parameter	Unit					
PERE	MJ_{NCV}	2.91E+01	3.05E+01	2.78E+01	3.13E+01	2.90E+01
PERM	MJ_{NCV}	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PERT	MJ_{NCV}	2.91E+01	3.05E+01	2.78E+01	3.13E+01	2.90E+01
PENRE	MJ_{NCV}	6.92E+02	8.94E+02	6.50E+02	1.09E+03	6.86E+02
PENRM	MJ_{NCV}	2.88E+03	2.60E+03	2.15E+03	2.74E+03	2.60E+03
PENRT	MJ_{NCV}	3.57E+03	3.49E+03	2.80E+03	3.83E+03	3.29E+03
SM	kg	0.00E+00	0.00E+00	1.77E+02	0.00E+00	0.00E+00
RSF	MJ_{NCV}	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NRSF	MJ_{NCV}	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
FW	m3	6.95E-01	1.14E+00	5.90E-01	1.62E+00	6.66E-01
HWD	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NHWD	kg	3.06E-02	3.04E-02	2.51E-02	3.15E-02	2.85E-02
RWD	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
CRU	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
MFR	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
MER	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
EE	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Table 10: Environmental profiles of asphalt products manufactured at Dandenong, stages A1-A3, per tonne

	Product	Size 20mm DGA Type SS	Size 20mm DGA Type SS 30% RAP	Size 14, 20mm DGA Type SI	Size 14mm DGA Type SI 10% RAP	Size 14, 20mm DGA Type SI 20% RAP ≤5% Glass	Size 20 mm DGA Type SI 30% RAP
	Standard	DoT - Section 407 Dense Graded Asphalt (DGA)					
Indicator	Unit						
Global warming (total)	kg CO_2 eq	62.9	52.8	63.9	61.4	57.3	52.7
GWP-fossil	kg CO_2 eq	62.9	52.8	63.8	61.4	57.1	52.7
GWP-biogenic	kg CO_2 eq	0.0181	0.0127	0.0189	0.0178	0.158	0.0125
GWP-land use	kg CO_2 eq	1.93E-04	1.26E-04	1.97E-04	1.76E-04	1.57E-04	1.31E-04
Ozone layer depletion	kg CFC11 eq	2.30E-05	1.52E-05	2.43E-05	2.29E-05	1.96E-05	1.52E-05
Acidification, soil and water	kg SO_2 eq	0.309	0.216	0.323	0.305	0.266	0.217
Eutrophication	kg PO_4^{3-}eq	0.0222	0.0176	0.0226	0.0214	0.0197	0.0176
Photochemical ozone creation	kg C_2H_4 eq	0.0506	0.0366	0.0527	0.0498	0.0443	0.0367
Abiotic depletion - elements	kg Sb eq	2.66E-07	1.97E-07	2.78E-07	2.72E-07	2.21E-07	1.84E-07
Abiotic depletion - fossil	MJ_{NCV}	2800	1960	2940	2780	2420	1960

Table 11: Environmental parameters of asphalt products manufactured at Dandenong, stages A1-A3, per tonne

	Product	Size 20mm DGA Type SS	Size 20mm DGA Type SS 30% RAP	Size 14, 20mm DGA Type SI	Size 14mm DGA Type SI 10% RAP	Size 14, 20mm DGA Type SI 20% RAP ≤5% Glass	Size 20 mm DGA Type SI 30% RAP
	Standard	DoT - Section 407 Dense Graded Asphalt (DGA)					
Parameter	Unit						
PERE	MJ_{NCV}	2.93E+01	2.64E+01	2.94E+01	2.85E+01	2.77E+01	2.66E+01
PERM	MJ_{NCV}	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PERT	MJ_{NCV}	2.93E+01	2.64E+01	2.94E+01	2.85E+01	2.77E+01	2.66E+01
PENRE	MJ_{NCV}	6.96E+02	6.02E+02	7.00E+02	6.73E+02	6.34E+02	6.01E+02
PENRM	MJ_{NCV}	2.31E+03	1.49E+03	2.46E+03	2.31E+03	1.96E+03	1.49E+03
PENRT	MJ_{NCV}	3.01E+03	2.10E+03	3.16E+03	2.99E+03	2.60E+03	2.10E+03
SM	kg	0.00E+00	2.76E+02	0.00E+00	9.04E+01	1.96E+02	2.76E+02
RSF	MJ_{NCV}	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NRSF	MJ_{NCV}	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
FW	m^3	6.29E-01	4.95E-01	6.61E-01	6.63E-01	5.34E-01	4.46E-01
HWD	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NHWD	kg	2.68E-02	1.93E-02	2.82E-02	2.72E-02	2.34E-02	1.87E-02
RWD	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
CRU	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
MFR	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
MER	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
EE	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Table 12: Environmental profiles of asphalt products manufactured at Dandenong, stages A1-A3, per tonne

	Product	Size 20mm DGA Type SF	Size 20mm DGA Type SF 20% RAP ≤5% Glass	Size 20mm DGA Type SF 30-40% RAP	Size 14mm DGA Type VP
	Standard	DoT - Section 407 Dense Graded Asphalt (DGA)			
Indicator	Unit				
Global warming (total)	kg CO_2 eq	66.3	59.6	55.0	79.7
GWP-fossil	kg CO_2 eq	66.3	59.4	55.0	79.7
GWP-biogenic	kg CO_2 eq	0.0205	0.228	0.0141	0.0748
GWP-land use	kg CO_2 eq	2.09E-04	1.69E-04	1.38E-04	2.76E-04
Ozone layer depletion	kg CFC11 eq	2.74E-05	2.27E-05	1.84E-05	2.45E-05
Acidification, soil and water	kg SO_2 eq	0.357	0.301	0.252	0.391
Eutrophication	kg PO_4^{3-}eq	0.0238	0.0208	0.0188	0.0266
Photochemical ozone creation	kg C_2H_4 eq	0.0578	0.0496	0.0420	0.0650
Abiotic depletion - elements	kg Sb eq	2.97E-07	2.40E-07	2.03E-07	7.10E-07
Abiotic depletion - fossil	MJ_{NCV}	3260	2750	2300	3270

Table 13. Environmental parameters of asphalt products manufactured at Dandenong, stages A1-A3, per tonne

	Product	Size 20mm DGA Type SF	Size 20mm DGA Type SF 20% RAP ≤5% Glass	Size 20mm DGA Type SF 30-40% RAP	Size 14mm DGA Type VP
	Standard	DoT - Section 407 Dense Graded Asphalt (DGA)			
Parameter	Unit				
PERE	MJNCV	2.98E+01	2.80E+01	2.67E+01	3.13E+01
PERM	MJNCV	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PERT	MJNCV	2.98E+01	2.80E+01	2.67E+01	3.13E+01
PENRE	MJNCV	7.14E+02	6.44E+02	6.11E+02	1.06E+03
PENRM	MJNCV	2.80E+03	2.31E+03	1.86E+03	2.46E+03
PENRT	MJNCV	3.51E+03	2.96E+03	2.47E+03	3.52E+03
SM	kg	0.00E+00	2.05E+02	3.15E+02	0.00E+00
RSF	MJNCV	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NRSF	MJNCV	0.00E+00	0.00E+00	0.00E+00	0.00E+00
FW	m^3	6.97E-01	5.75E-01	4.85E-01	1.51E+00
HWD	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NHWD	kg	3.11E-02	2.66E-02	2.18E-02	2.99E-02
RWD	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00
CRU	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00
MFR	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00
MER	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00
EE	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Table 14: Environmental profiles of asphalt products manufactured at Dandenong, stages A1-A3, per tonne

	Product	Size 10mm OGA	Size 7, 10mm SMA Type H/N	Size 10, 14mm LTCRA ≤15% RAP	Size 7mm RGG
	Standard	DoT - Section 417 Open Graded Asphalt (OGA)	DoT - Section 404 Stone Mastic Asphalt (SMA) or AS2150	DoT - Section 422 Light Traffic Crumb Rubber Asphalt (LTCRA)	DoT - Section 405 Regulation Gap Graded Asphalt (RGG)
Indicator	Unit				
Global warming (total)	kg CO_2 eq	83.9	79.0	64.3	60.8
GWP-fossil	kg CO_2 eq	83.8	79.0	64.3	60.7
GWP-biogenic	kg CO_2 eq	0.0853	-0.0733	0.0240	0.0207
GWP-land use	kg CO_2 eq	3.19E-04	4.21E-04	1.77E-04	2.18E-04
Ozone layer depletion	kg CFC11 eq	2.92E-05	2.90E-05	2.23E-05	2.89E-05
Acidification, soil and water	kg SO_2 eq	0.448	0.457	0.304	0.373
Eutrophication	kg PO_4^{3-}eq	0.0275	0.0286	0.0227	0.0236
Photochemical ozone creation	kg C_2H_4 eq	0.0741	0.0736	0.0494	0.0587
Abiotic depletion - elements	kg Sb eq	7.67E-07	4.50E-04	2.66E-07	3.02E-07
Abiotic depletion - fossil	MJ_{NCV}	3770	3820	2750	3450

Table 15: Environmental parameters of asphalt products manufactured at Dandenong, stages A1-A3, per tonne

	Product	Size 10mm OGA	Size 7, 10mm SMA Type H/N	Size 10, 14mm LTCRA ≤15% RAP	Size 7mm RGG
	Standard	DoT - Section 417 Open Graded Asphalt (OGA)	DoT - Section 404 Stone Mastic Asphalt (SMA) or AS2150	DoT - Section 422 Light Traffic Crumb Rubber Asphalt (LTCRA)	DoT - Section 405 Regulation Gap Graded Asphalt (RGG)
Parameter	Unit				
PERE	MJ_{NCV}	3.29E+01	4.13E+01	3.05E+01	2.89E+01
PERM	MJ_{NCV}	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PERT	MJ_{NCV}	3.29E+01	4.13E+01	3.05E+01	2.89E+01
PENRE	MJ_{NCV}	1.10E+03	1.11E+03	7.13E+02	6.85E+02
PENRM	MJ_{NCV}	2.97E+03	3.00E+03	2.25E+03	3.04E+03
PENRT	MJ_{NCV}	4.07E+03	4.11E+03	2.96E+03	3.72E+03
SM	kg	0.00E+00	0.00E+00	8.44E+01	0.00E+00
RSF	MJ_{NCV}	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NRSF	MJ_{NCV}	0.00E+00	0.00E+00	0.00E+00	0.00E+00
FW	m^3	1.55E+00	1.61E+00	6.40E-01	6.88E-01
HWD	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NHWD	kg	3.33E-02	4.09E-02	4.08E-02	3.11E-02
RWD	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00
CRU	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00
MFR	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00
MER	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00
EE	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Table 16: Environmental profiles of asphalt products manufactured at Dandenong, stages A1-A3, per tonne

	Product	Size 14mm GG CR	Size 7mm DGA Fine	Size 10mm DGA Fine	Size 10mm PlastiPhalt®	Size 14mm PlastiPhalt®	Size 14, 20mm PortPhalt®
	Standard	AS 2150			Proprietary		
Indicator	Unit						
Global warming (total)	kg CO_2 eq	70.5	63.5	87.2	62.2	73.5	69.5
GWP-fossil	kg CO_2 eq	70.5	63.5	87.1	62.2	73.4	69.5
GWP-biogenic	kg CO_2 eq	0.0347	0.0221	0.0832	0.0177	0.0680	0.00610
GWP-land use	kg CO_2 eq	2.26E-04	2.13E-04	2.95E-04	1.72E-04	2.36E-04	1.94E-04
Ozone layer depletion	kg CFC11 eq	2.89E-05	3.07E-05	2.97E-05	2.36E-05	2.08E-05	2.27E-05
Acidification, soil and water	kg SO_2 eq	0.377	0.394	0.459	0.315	0.343	0.313
Eutrophication	kg PO_4^{3-}eq	0.0252	0.0249	0.0299	0.0221	0.0241	0.0242
Photochemical ozone creation	kg C_2H_4 eq	0.0600	0.0617	0.0754	0.0515	0.0576	0.0525
Abiotic depletion - elements	kg Sb eq	2.80E-07	3.46E-07	8.08E-07	2.59E-07	6.35E-07	3.78E-07
Abiotic depletion - fossil	MJ_{NCV}	3450	3650	3880	2870	2850	2950

Table 17: Environmental parameters of asphalt products manufactured at Dandenong, stages A1-A3, per tonne

	Product	Size 14mm GG CR	Size 7mm DGA Fine	Size 10mm DGA Fine	Size 10mm PlastiPhalt®	Size 14mm PlastiPhalt®	Size 14, 20mm PortPhalt®
	Standard	AS 2150			Proprietary		
Parameter	Unit						
PERE	MJ_{NCV}	3.44E+01	2.88E+01	3.19E+01	2.82E+01	2.96E+01	3.08E+01
PERM	MJ_{NCV}	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PERT	MJ_{NCV}	3.44E+01	2.88E+01	3.19E+01	2.82E+01	2.96E+01	3.08E+01
PENRE	MJ_{NCV}	7.49E+02	7.11E+02	1.14E+03	6.79E+02	9.83E+02	9.10E+02
PENRM	MJ_{NCV}	2.97E+03	3.23E+03	3.04E+03	2.41E+03	2.08E+03	2.25E+03
PENRT	MJ_{NCV}	3.71E+03	3.94E+03	4.18E+03	3.09E+03	3.07E+03	3.16E+03
SM	kg	1.95E+01	0.00E+00	0.00E+00	1.72E+02	1.73E+02	0.00E+00
RSF	MJ_{NCV}	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NRSF	MJ_{NCV}	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
FW	m^3	6.01E-01	8.33E-01	1.74E+00	6.16E-01	1.35E+00	7.54E-01
HWD	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NHWD	kg	6.17E-02	3.42E-02	3.60E-02	2.74E-02	2.59E-02	3.71E-02
RWD	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
CRU	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
MFR	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
MER	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
EE	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Environmental Profiles for Asphalt Products at Lara

Table 18: Environmental profiles of asphalt products manufactured at Lara, stages A1-A3, per tonne

	Product	Size 7, 10, 14mm DGA Type H	Size 10, 14mm DGA Type H 10% RAP	Size 7, 10mm DGA Type L	Size 10mm DGA Type L 10% RAP
	Standard	DoT - Section 407 Dense Graded Asphalt (DGA)			
Indicator	Unit				
Global warming (total)	kg CO_2 eq	62.3	58.2	64.7	60.2
GWP-fossil	kg CO_2 eq	62.3	58.2	64.6	60.1
GWP-biogenic	kg CO_2 eq	0.0280	0.0265	0.0288	0.0275
GWP-land use	kg CO_2 eq	1.59E-04	1.22E-04	1.71E-04	1.33E-04
Ozone layer depletion	kg CFC11 eq	2.74E-05	2.39E-05	3.00E-05	2.62E-05
Acidification, soil and water	kg SO_2 eq	0.359	0.318	0.388	0.344
Eutrophication	kg PO_4^{3-}eq	0.0237	0.0221	0.0247	0.0229
Photochemical ozone creation	kg C_2H_4 eq	0.0547	0.0488	0.0591	0.0527
Abiotic depletion - elements	kg Sb eq	8.33E-07	8.65E-07	8.07E-07	8.63E-07
Abiotic depletion - fossil	MJ_{NCV}	3310	2930	3600	3180

Table 19: Environmental parameters of asphalt products manufactured at Lara, stages A1-A3, per tonne

	Product	Size 7, 10, 14mm DGA Type H	Size 10, 14mm DGA Type H 10% RAP	Size 7, 10mm DGA Type L	Size 10mm DGA Type L 10% RAP
	Standard	DoT - Section 407 Dense Graded Asphalt (DGA)			
Parameter	Unit				
PERE	MJ_{NCV}	2.82E+01	2.78E+01	2.83E+01	2.80E+01
PERM	MJ_{NCV}	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PERT	MJ_{NCV}	2.82E+01	2.78E+01	2.83E+01	2.80E+01
PENRE	MJ_{NCV}	7.07E+02	6.71E+02	7.22E+02	6.82E+02
PENRM	MJ_{NCV}	2.86E+03	2.48E+03	3.16E+03	2.75E+03
PENRT	MJ_{NCV}	3.57E+03	3.15E+03	3.88E+03	3.43E+03
SM	kg	0.00E+00	9.01E+01	0.00E+00	8.93E+01
RSF	MJ_{NCV}	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NRSF	MJ_{NCV}	0.00E+00	0.00E+00	0.00E+00	0.00E+00
FW	m^3	1.35E+00	1.34E+00	1.37E+00	1.36E+00
HWD	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NHWD	kg	5.01E-02	4.91E-02	5.11E-02	5.07E-02
RWD	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00
CRU	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00
MFR	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00
MER	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00
EE	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Table 20: Environmental profiles of asphalt products manufactured at Lara, stages A1-A3, per tonne

	Product	Size 7, 10, 14mm DGA Type N	Size 10, 14mm DGA Type N 10% RAP ≤5% Glass	Size 10, 14mm DGA Type HP	Size 10, 14mm DGA Type V
	Standard	DoT - Section 407 Dense Graded Asphalt (DGA)			
Indicator	Unit				
Global warming (total)	kg CO_2 eq	62.4	58.6	78.4	60.1
GWP-fossil	kg CO_2 eq	62.3	58.5	78.3	60.1
GWP-biogenic	kg CO_2 eq	0.0280	0.166	0.0888	0.0273
GWP-land use	kg CO_2 eq	1.59E-04	1.25E-04	2.39E-04	1.47E-04
Ozone layer depletion	kg CFC11 eq	2.74E-05	2.45E-05	2.60E-05	2.49E-05
Acidification, soil and water	kg SO_2 eq	0.359	0.325	0.416	0.331
Eutrophication	kg PO_4^{3-}eq	0.0237	0.0223	0.0275	0.0227
Photochemical ozone creation	kg C_2H_4 eq	0.0547	0.0502	0.0657	0.0505
Abiotic depletion - elements	kg Sb eq	8.33E-07	8.57E-07	1.33E-06	8.61E-07
Abiotic depletion - fossil	MJ_{NCV}	3310	2990	3510	3040

Table 21: Environmental parameters of asphalt products manufactured at Lara, stages A1-A3, per tonne

	Product	Size 7, 10, 14mm DGA Type N	Size 10, 14mm DGA Type N 10% RAP ≤5% Glass	Size 10, 14mm DGA Type HP	Size 10, 14mm DGA Type V
	Standard	DoT - Section 407 Dense Graded Asphalt (DGA)			
Parameter	Unit				
PERE	MJ_{NCV}	2.82E+01	2.79E+01	3.03E+01	2.81E+01
PERM	MJ_{NCV}	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PERT	MJ_{NCV}	2.82E+01	2.79E+01	3.03E+01	2.81E+01
PENRE	MJ_{NCV}	7.07E+02	6.69E+02	1.09E+03	6.93E+02
PENRM	MJ_{NCV}	2.86E+03	2.56E+03	2.69E+03	2.58E+03
PENRT	MJ_{NCV}	3.57E+03	3.23E+03	3.78E+03	3.27E+03
SM	kg	2.98E+01	1.06E+02	0.00E+00	0.00E+00
RSF	MJ_{NCV}	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NRSF	MJ_{NCV}	0.00E+00	0.00E+00	0.00E+00	0.00E+00
FW	m^3	1.35E+00	1.34E+00	2.26E+00	1.34E+00
HWD	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NHWD	kg	5.01E-02	4.96E-02	5.19E-02	4.94E-02
RWD	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00
CRU	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00
MFR	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00
MER	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00
EE	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Table 22: Environmental profiles of asphalt products manufactured at Lara, stages A1-A3, per tonne

	Product	Size 20mm DGA Type SS	Size 14, 20mm DGA Type SI ≤10% RAP	Size 14, 20mm DGA Type SI 10-20% RAP	Size 20mm DGA Type SF	Size 20mm DGA Type SF 10-20% RAP
	Standard	DoT - Section 407 Dense Graded Asphalt (DGA)				
Indicator	Unit					
Global warming (total)	kg CO_2 eq	58.3	59.0	55.2	61.7	56.5
GWP-fossil	kg CO_2 eq	58.3	59.0	55.2	61.7	56.3
GWP-biogenic	kg CO_2 eq	0.0273	0.0276	0.0249	0.0296	0.166
GWP-land use	kg CO_2 eq	1.35E-04	1.40E-04	1.04E-04	1.51E-04	1.13E-04
Ozone layer depletion	kg CFC11 eq	2.30E-05	2.39E-05	2.07E-05	2.73E-05	2.40E-05
Acidification, soil and water	kg SO_2 eq	0.310	0.319	0.283	0.357	0.317
Eutrophication	kg PO_4^{3-}eq	0.0220	0.0223	0.0208	0.0236	0.0216
Photochemical ozone creation	kg C_2H_4 eq	0.0474	0.0488	0.0436	0.0545	0.0492
Abiotic depletion - elements	kg Sb eq	9.22E-07	9.12E-07	8.61E-07	9.48E-07	8.49E-07
Abiotic depletion - fossil	MJ_{NCV}	2830	2920	2590	3290	2920

Table 23: Environmental parameters of asphalt products manufactured at Lara, stages A1-A3, per tonne

	Product	Size 20mm DGA Type SS	Size 14, 20mm DGA Type SI ≤10% RAP	Size 14, 20mm DGA Type SI 10-20% RAP	Size 20mm DGA Type SF	Size 20mm DGA Type SF 10-20% RAP
	Standard	DoT - Section 407 Dense Graded Asphalt (DGA)				
Parameter	Unit					
PERE	MJ_{NCV}	2.82E+01	2.82E+01	2.75E+01	2.87E+01	2.77E+01
PERM	MJ_{NCV}	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PERT	MJ_{NCV}	2.82E+01	2.82E+01	2.75E+01	2.87E+01	2.77E+01
PENRE	MJ_{NCV}	6.79E+02	6.83E+02	6.50E+02	6.96E+02	6.42E+02
PENRM	MJ_{NCV}	2.36E+03	2.46E+03	2.14E+03	2.84E+03	2.51E+03
PENRT	MJ_{NCV}	3.04E+03	3.14E+03	2.79E+03	3.54E+03	3.15E+03
SM	kg	0.00E+00	0.00E+00	1.21E+02	0.00E+00	1.36E+02
RSF	MJ_{NCV}	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NRSF	MJ_{NCV}	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
FW	m^3	1.34E+00	1.34E+00	1.30E+00	1.40E+00	1.31E+00
HWD	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NHWD	kg	5.03E-02	5.05E-02	4.68E-02	5.43E-02	4.91E-02
RWD	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
CRU	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
MFR	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
MER	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
EE	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Table 24: Environmental profiles of asphalt products manufactured at Lara, stages A1-A3, per tonne

	Product	Size 10mm OGA (A20E)	Size 10mm SMA Type H/N	Size 10mm LTCRA ≤10% RAP ≤5% Glass	Size 10, 14mm Plastiphalt®
	Standard	DoT - Section 417 Open Graded Asphalt (OGA)	DoT - Section 404 Stone Mastic Asphalt (SMA)	DoT - Section 422 Light Traffic Crumb Rubber Asphalt (LTCRA) or AS2150	Proprietary
Indicator	Unit				
Global warming (total)	kg CO_2 eq	80.6	83.1	60.8	73.4
GWP-fossil	kg CO_2 eq	80.5	83.1	60.6	73.4
GWP-biogenic	kg CO_2 eq	0.0937	-0.0642	0.170	0.0827
GWP-land use	kg CO_2 eq	2.14E-04	3.48E-04	1.32E-04	2.08E-04
Ozone layer depletion	kg CFC11 eq	2.87E-05	2.92E-05	2.45E-05	2.25E-05
Acidification, soil and water	kg SO_2 eq	0.446	0.467	0.328	0.372
Eutrophication	kg PO_4^{3-}eq	0.0288	0.0313	0.0231	0.0257
Photochemical ozone creation	kg C_2H_4 eq	0.0702	0.0740	0.0502	0.0591
Abiotic depletion - elements	kg Sb eq	1.58E-06	4.52E-04	8.34E-07	1.26E-06
Abiotic depletion - fossil	MJ_{NCV}	3780	3830	3010	3120

Table 25: Environmental parameters of asphalt products manufactured at Lara, stages A1-A3, per tonne

	Product	Size 10mm OGA (A20E)	Size 10mm SMA Type H/N	Size 10mm LTCRA ≤10% RAP ≤5% Glass	Size 10, 14mm Plastiphalt®
	Standard	DoT - Section 417 Open Graded Asphalt (OGA)	DoT - Section 404 Stone Mastic Asphalt (SMA)	DoT - Section 422 Light Traffic Crumb Rubber Asphalt (LTCRA) or AS2150	Proprietary
Parameter	Unit				
PERE	MJ_{NCV}	3.19E+01	4.23E+01	2.92E+01	2.95E+01
PERM	MJ_{NCV}	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PERT	MJ_{NCV}	3.19E+01	4.23E+01	2.92E+01	2.95E+01
PENRE	MJ_{NCV}	1.10E+03	1.15E+03	6.96E+02	1.04E+03
PENRM	MJ_{NCV}	2.98E+03	2.97E+03	2.55E+03	2.31E+03
PENRT	MJ_{NCV}	4.08E+03	4.12E+03	3.24E+03	3.35E+03
SM	kg	0.00E+00	0.00E+00	8.20E+01	8.55E+01
RSF	MJ_{NCV}	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NRSF	MJ_{NCV}	0.00E+00	0.00E+00	0.00E+00	0.00E+00
FW	m^3	2.54E+00	2.37E+00	1.32E+00	2.12E+00
HWD	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NHWD	kg	6.38E-02	7.11E-02	5.88E-02	4.76E-02
RWD	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00
CRU	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00
MFR	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00
MER	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00
EE	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Case Studies

City of Port Phillip becomes the first council to use Fulton Hogan's recycled plastic asphalt product, PlastiPhalt®

Fulton Hogan's first full scale production project utilising PlastiPhalt® in Mozart Street, St Kilda was completed in September 2019, saving the plastic waste from more than 150 cars from landfill.

PlastiPhalt® is designed to not only to provide a beneficial reuse for waste plastic, but also to achieve a durable, long-term asphalt pavement that will out-perform traditional asphalt.

As an additional environmental benefit for this project, the asphalt mix was produced as a warm-mix, which significantly reduces carbon emissions related to heating aggregates and bitumen compared to hot-mix asphalt.

The mix also contained 20% Reclaimed Asphalt Pavement (RAP) to further boost the environmental sustainability credentials of this innovative product.

The upgrade of Mozart Street is known to be the first time recycled plastic had been used for substantial road resurfacing in the council area. The wet blend method used by Fulton Hogan's PlastiPhalt® ensured the asphalt mix did not contain microplastics that have plagued Melbourne's waterways and Port Phillip Bay.

Fulton Hogan partners with City of Greater Geelong to deliver a sustainable wearing course asphalt using end-of-life tyres and recycled glass.

In a great example of circular economy done right, Fulton Hogan placed more than 400 tonnes of wearing course asphalt containing recycled glass, end-of-life tyres, and Reclaimed Asphalt Pavement (RAP) at Minerva Rd, Manifold Heights as part of pavement rehabilitation works for the City of Greater Geelong.

Some of the waste glass used to construct the asphalt pavement for this project was sourced from Geelong resident's recycling bins, making this project a model for how local waste can be utilised as an input into infrastructure projects for the benefit of the community.

Overall, this project utilised almost 60 tonnes of recycled material, including the equivalent of approximately 190,000 glass bottles and 450 car tyres.

As well as providing a local reuse option for material that might otherwise be sent to landfill, the use of glass, old tyres and RAP in asphalt also reduces carbon-intensity by eliminating emissions generated from mining and quarrying raw materials. It means that less energy is used to construct the road and that more virgin materials are left in the ground.

Fulton Hogan, in partnership with Warrnambool City Council and Moyne Shire, have used recycled kerbside glass to build new roads.

Warrnambool City Council, in conjunction with the VicRoads *Roads to Recovery Program,* identified the section of Walsh Road between Raglan Parade and Bradley Street as needing a full rehabilitation due to pavement failures.

Walsh Road was rebuilt using the new method of recycling glass bottles and jars. Approximately 15 tonnes, or the equivalent of 83,300 empty glass beer bottles worth of glass, was crushed and used by Fulton Hogan for the project.

The glass was used as a substitute for sand in the asphalting process. It was collected from three community glass recycling bins placed around Warrnambool, as well as from the Moyne Shire's kerbside glass collection.

This overall project was a great result for the local community and truly delivers on sustainable circular economy objectives.

Regional Roads Victoria, in partnership with Fulton Hogan, delivers a range of sustainability benefits for works on the Princes Highway in Yarragon.

The 2,300 tonnes of asphalt supplied by Fulton Hogan for this project utilised recycled materials, including recycled glass, recycled plastic and Reclaimed Asphalt Pavement (RAP).

Almost 75 tonnes of recycled glass - equivalent to 300,000 glass bottle - 2.6 tonnes of locally sourced shredded recycled plastic - equivalent to plastic waste from 865 cars - and over 600 tonnes of old asphalt pavements were used in this project.

Monash Freeway Upgrade Stage 2 elects to use Fulton Hogan's high-RAP asphalt.

Fulton Hogan has supplied a large volume of asphalt containing a maximum content of recycled material to the Monash Freeway Upgrade Stage 2. The high-recycled content asphalt used in the project was designed by Fulton Hogan's in-house laboratory and contains up to 40% RAP.

The RAP used in the Monash Freeway Upgrade works was sourced from local roads where the existing asphalt pavement required removal, including sections of the Monash Freeway itself.

Closely monitoring the quality of the RAP used in the asphalt means that Fulton Hogan can be certain of producing materials that withstand the heavy traffic volumes on the Monash Freeway over the long-term, which is a truly sustainable outcome.

Old tyres find new life on the Meander Valley Council road network.

As part of Meander Valley Council and Fulton Hogan's commitment to a sustainable future, part of the municipality's road network has been resurfaced using waste and recycled materials.

A number of roads in Prospect Vale were the first in Tasmania to be resurfaced with products containing crushed glass as a substitute for sand and aggregate, and crumb rubber from old tyres.

When used in asphalt and sprayed seals, crumb rubber from tyres can improve the strength and longevity of road surfaces.


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