Downer
Relationships creating success

Reconophalt™ NSW

Environmental Product Declaration in accordance with ISO 14025 and EN15804

Program: EPD Australasia Limited, www.epd-australasia.com
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AUSTRALASIA EPD®

ECO PLATFORM EPD VERIFIED

Contents

Owner of the EPD

Downer EDI Works Pty Ltd
Triniti Business Campus, 39 Delhi Road
North Ryde NSW 2114

+61 2 9468 9700

Name and location of production site

Manufacturing of the Reconophalt™ NSW mixes is undertaken at Downer's Asphalt Plant in Rosehill, New South Wales.

About Downer

At Downer, our customers are at the heart of everything we do.

We exist to create and sustain the modern environment, and our promise is to work closely with our customers to help them succeed, using world-leading insights and solutions.

Our business is founded on four pillars:

Safety

Zero Harm is embedded in Downer's culture and is fundamental to the company's future success

Delivery

We build trust by delivering on our promises with excellence while focusing on safety, value for money and efficiency

Relationships

We collaborate to build and sustain enduring relationships based on trust and integrity

Thought leadership

We remain at the forefront of our industry by employing the best people and having the courage to challenge the status quo

With a history dating back more than 150 years, Downer builds, manages and maintains road networks across Australia and New Zealand, and manufactures and supplies products and services to create safe, efficient and reliable journeys.

A leading manufacturer and supplier of bitumen-based products, Downer is an innovator in the sustainable asphalt industry and circular economy, using recycled products and environmentally sustainable methods to produce asphalt.

Reconophalt™ was born of Downer's rich history of identifying and understanding the evolving challenges our customers face, and working to develop innovative solutions to support our customer's continued success.

Reconophalt™ provides an avenue for our customers to realise the direct re-use of local waste streams, and further, provides for the full recovery of the high-economic and environmental value of the bitumen content within recycled asphalt pavement, which plays an important role in our various Reconophalt™ mix options.

Our research and development team continues to further develop and refine our Reconophalt™ product options to this day, with ongoing theoretical development, testing and trials to create new mixes that meet our customer's unique project challenges.

How to use this EPD

Downer recognises the importance of the transparency and independent verification of our products' credentials.

This Environmental Product Declaration (EPD) covers the environmental impacts of high-recycled-content asphalt manufactured to the Transport for New South Wales (TfNSW) Specification D&C R116 Heavy Duty Dense Graded Asphalt.

This product is typically used to surface roads for local government organisations, state road authorities, and private developers.

General guidance

EPDs are independently verified documents that include information about the environmental impact of products throughout their life cycle.

EPDs require the completion of Life Cycle Inventory (LCI), a Life Cycle Assessment (LCA) and verification to best practice international and Australian standards.

- Life Cycle Inventory (LCI) is the collection of data on the inputs, processes and outputs within a defined system boundary
- Life Cycle Assessment (LCA) is the modelling of LCI in accordance with ISO 14040 and ISO 14044 standards
- Third party verification of the output of the LCA in the format of an EPD
- PCR 2018:04 Asphalt Mixtures, Version 1.03, 2019-09-06
- Appendix to Product Category Rules for Asphalt Mixtures – Australia (v2019-01-22).

The EPD owner has the sole ownership, liability and responsibility for the EPD.

EPDs are not always comparable

When comparing EPDs it is important to recognise:

- EPDs within the same product category from different programmes may not be comparable
- EPDs of construction products may not be comparable if they do not comply with ISO 14025:2006 or if they are produced using different Product Category Rules

Understanding the detail is important in comparisons. Expert analysis is required to ensure data is truly comparable to avoid unintended distortions.

Benefits of using this EPD

This EPD provides an independently-verified representation of the environmental impact of Reconophalt produced in NSW.

EPDs promote a new, environmental way of thinking and their focus on making transparent data readily available could have the potential to encourage change within the wider manufacturing and supply chain itself, leading to a higher level of credibility and sustainability across the construction industry as a whole

Green Star® Points

Green Building Council Australia

Reconophalt contributes towards satisfying Credit 21 in the following Green Star® rating tools:

- ✓ Design and As Built v.1.2, v1.3 and Buildings v1

Products are not reviewed or certified under the Green Star rating system. Green Star credit requirements cover the performance of materials in aggregate, not the performance of individual products or brands. For more information on Green Star, visit www.gbca.org.au.

Infrastructure Sustainability Council's IS® rating scheme

Infrastructure Sustainability Council

This EPD complies with requirements under the Infrastructure Sustainability Council's IS® rating scheme:

- ✓ Compliant with ISO 14025
- ✓ Compliant with EN15804
- ✓ Verified by a third party.

This EPD may help your project achieve ISv2.1 Rso-7, ISv1.2 Mat-2 and ISOps v1.2 Mat-2 under the IS rating scheme.

Program information

Program

EPD Australasia Limited

315a Hardy Street
Nelson 7010
New Zealand

www.epd-australasia.com
info@epd-australasia.com

Product category rules (PCR)

PCR 2018:04 Asphalt Mixtures, Version 1.03, 2019-09-06

Appendix to Product Category Rules for Asphalt Mixtures - Australia (v2019-01-22)

PCR review

PCR review was conducted by The Technical Committee of the International EPD® System. Chair: Massimo Marino. Contact via info@environdec.com

Independent third-party verification

Independent third-party verification of the declaration and data, according to ISO 14025:2006:

☐ EPD process certification ☑ EPD verification

Third party verifier

Kimberly Robertson
Catalyst, PO Box 214, Katikati 3166, NZ
+64 (0)27 220 4417
www.catalystnz.co.nz

Approved by EPD Australasia

Procedure for follow-up

Procedure for follow-up of data during EPD validity involves third party verifier:

☐ Yes ☑ No

The EPD owner has the sole ownership, liability, and responsibility for the EPD. EPDs within the same product category but from different programmes may not be comparable. EPDs of construction products may not be comparable if they do not comply with EN 15804.

Benefits of using Reconophalt™

Downer's Reconophalt™ is an asphalt product containing high-recycled content derived from true waste streams that would otherwise be bound for landfill. Materials are sourced through Downer's exclusive partnerships with Close the Loop, Repurpose It, Suez, Downer's own detritus repurposing facilities, and other suppliers of recycled resources.

Reconophalt™ is suitable for most applications where standard asphalt is specified. Pavement construction using Reconophalt™ is as per traditional methodologies, using standard paving equipment.

Our mixes comply with AS2150 and standard state road authority specifications, while providing a marked increase in fatigue resistance for longer pavement life and superior resistance to deformation.

Reconophalt™ supports our customers across Australia in meeting the challenges of global economic uncertainty, the risks of climate change, and our country's current waste crisis through:

- Diversion of waste from landfill, creating a true circular economy
- Reducing requirements for virgin bitumen and quarry materials
- Substantially stronger asphalt with better deformation resistance over time
- Extending asset life by up to 15%
- Providing protection from significant bitumen price volatility
- Significant reduction in CO_2e emissions

Product name

Reconophalt™ NSW

Product identification

Asphalt containing high-recycled content to AS2150

UN CPC code

15330

Other codes for product classification

ANZSIC Code 3101 Road and Bridge Construction

Geographical scope

New South Wales

LCA information

Declared unit and Reference Service Life (RSL)

The declared unit for this EPD is 1 metric tonne of manufactured asphalt mixture which fulfils the specified quality criteria during the Reference Service Life (RSL) of 20 years.

Although the service life of asphalt is 20 years, the default service life of roads as per the Australian Appendix to PCR for Asphalt Mixtures (v2019-01-22) is 40 years. To adhere to this, the LCA is modelled such that there will be a complete replacement of asphalt at 20 years, thereby adding another 20 years to the service life of asphalt. Modules B1-C4 and D incorporate this consideration while calculating the impacts.

Databases and LCA software used

The software used was SimaPro® LCA software (v 9.1.1.1). The inventory data for the processes are entered in the LCA software and linked to the pre-existing background data for upstream feedstocks and services. Inventory data was selected per the standards, in the following order of preference:

1. The Australian Life Cycle Inventory Shadow Database (AusLCI shadow database) v1.27 being compiled by the Australian Life Cycle Assessment Society (ALCAS) – this data will comply with the AusLCI Data Guidelines (Australian Life Cycle Inventory Database Initiative (AusLCI, 2017). At the time of this LCA, the AusLCI shadow database was 5 years old.[1]
2. The Australian Life Cycle Inventory (AusLCI) v1.36 being compiled by the Australian Life Cycle Assessment Society (ALCAS) – this data will comply with the AusLCI Data Guidelines (Australian Life Cycle Inventory Database Initiative (AusLCI, 2021). At the time of this report, the AusLCI database was 1 years old.[2]
3. 3. Ecoinvent 3.8 database (Ecoinvent Centre, 2021) for all processes taking place overseas i.e. outside Australia, using global average processes. At the time of this LCA, the Ecoinvent database was 1 year old.[4]

Description of system boundaries and excluded lifecycle stages

This EPD includes all life cycle stages from extraction of raw materials to disposal. The scope of LCA for this EPD is cradle to gate with options (modules A1-A3, C1-C4 and D), while the geographic scope is the state of New South Wales, wherein the construction site is within 27 km radius of Downer's Rosehill plant.

All modules included in this EPD are marked as X in the table below and those excluded are marked as 'Module not declared'(MND). The system boundary for this EPD is depicted in the figure below.

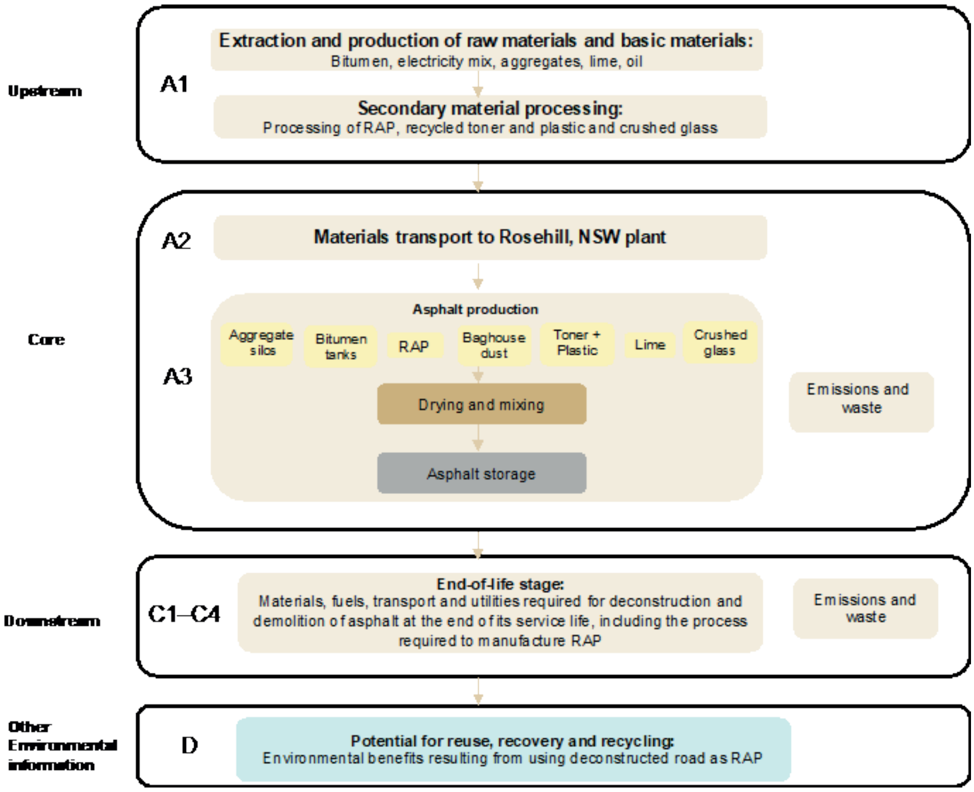
Table 1: Life Cycle of building products: stages and modules included in this EPD

GPI Module		Asset life cycle stage	Information module	Declared modules
Upstream	A1	Raw material supply	A1-3. Manufacturing stage	X
Core	A2	Transport		X
	A3	Manufacturing		X
Downstream	A4	Transport	A4-5. Construction stage	MND
	A5	Construction, installation process		MND
	B1	Material emissions from usage	B. Usage stage	MND
	B2	Maintenance		MND
	B3	Repair		MND
	B4	Replacement		MND
	B5	Refurbishment		MND
	B6	Operational energy use		MND
	B7	Operational water use		MND
	C1	Deconstruction and demolition	C. End of life	X
	C2	Transport		X
	C3	Waste processing		X
	C4	Disposal		X
Other environmental information	D	Reuse, recycle or recovery	D. Recyclability potentials	X

System diagram

The processes included in the LCA are presented in a process diagram in the figure below.

Figure 1: System diagram



Upstream processes

The upstream processes include those involved in Module A1 – Raw material supply. This module includes:

- Extraction, transport and manufacturing of raw materials.
- Generation of electricity from primary and secondary energy resources, also including their extraction, refining and transport for Modules A1 and A3.

Electricity inputs in foreground processes based in Australia were modelled based on the state-specific grid. The AusLCI database was used to model electricity in the foreground processes. The AusLCI dataset was updated using state-specific grid data sourced from the Department of the Environment and Energy (Department of the Environment and Energy, December 2020).

Core processes

The core processes include those involved in Module A2 and Module A3, including:

- External transportation of materials to the core processes and internal transport.
- Manufacturing of the asphalt mixes.
- Treatment of external recycled materials for reuse.

Downstream processes

The downstream processes include those involved in Module A4 to C4, including:

- Transport of equipment and use of materials for deconstruction at the end of life.
- Transport of waste generated at the end of life for reuse.
- Treatment of waste generated at the end of life for reuse.

LCA modelling scenarios

Two scenarios were modelled to ensure a comprehensive lifecycle analysis of the product. These scenarios are currently in use and representative of one of the most likely scenario alternatives.

Scenario 1 assumes that at the end-of-life of the road i.e. 40 years, the asphalt is left as is and no deconstruction occurs. The only deconstruction occurring in this scenario is during the complete replacement of asphalt at 20 years.

Scenario 2 assumes that at the end-of-life of the road i.e. 40 years, deconstruction occurs and the asphalt removed is to be transported to Camellia for recycling into Recycled Asphalt Pavement (RAP). This means that in scenario 2, the deconstruction occurs twice i.e. once at 20 years and then at 40 years.

All environmental impacts from A1-B4 will thus be identical for scenario 1 and 2. Only the impacts from C1-C4 and benefits in D will change for scenario 2.

Data quality

Foreground data on raw material requirements, manufacture, construction, use and end of life inputs is for FY2018-2019. The data sources and their assessed quality are detailed in Table 2. Overall, the data quality for this LCA was considered High.

Table 2: Data Quality

Module	Input/output	Data source	Temporal scope	Quality
A1	Bitumen (A15E and AR450 Binder)	Downer Mix Designs (Downer), Engineering Manager (Downer) and Department of the Environment and Energy	FY2020-2021	High
	Aggregates			
	Dust			
	Sand			
	RAP			
	Crushed glass			
	Hydrated lime			
	Baghouse dust			
	Toner-Plas			
	Reconomy sand			
A2	Transport distances from raw material suppliers to Downer's Asphalt Plant at Rosehill	Engineering Manager (Downer)	FY2020-2021	High
A3	Electricity and natural gas used for manufacturing of Reconophalt mixes	Electricity, fuel and gas bills from Downer and grid composition from the Department of the Environment and Energy	FY2020-2021	High

Module	Input/output	Data source	Temporal scope	Quality
C1	Diesel and water consumption for deconstruction	Profiling Leading Hand (Downer)	FY2020-2021	High
C2	Transport of waste to recycling sites	Engineering Manager (Downer)	FY2020-2021	High
C3	Diesel and water used for processing at Downer's plant	Maintenance and Recycling Manager (Downer)	FY2020-2021	High
C4	Materials disposed	Maintenance and Recycling Manager (Downer)	FY2020-2021	High
D	Materials recovered, recycled	Maintenance and Recycling Manager (Downer)	FY2020-2021	High

The EPD will be updated if changes in its lifecycle inventory lead to a variation of 10% or more in any of the included environmental indicators during its validity period.

Cut-off criteria

According to the PCR 2018:04 Asphalt mixtures (Version 1.03), the following criteria should be followed:

"Cut-off criteria to be met on the level of the modelled product system are the qualitative coverage of at least 99% of-both the energy, the mass, and the overall relevance of the flows"

Based on this guidance no energy or mass flows, except packaging of materials were excluded. All materials required for manufacturing are delivered in bulk via trucks and do not utilise any packaging. Although, some packaging may be used for the toner+plastic product used in mix AC14 AR450, the material itself accounts for 0.8% of the mass and hence its packaging is expected to account for less than 0.8%. So, packaging of materials is not included.

Allocation

According to the PCR 2018:04 v1.03 for Asphalt mixtures, in a process step where more than one type of product is generated, it is necessary to divide the unit process into different subprocesses that can be allocated to the coproducts and collecting the input and output data related to these subprocesses.

In the case of co-production, where the processes cannot be subdivided the coherence of the process must be followed. The allocation procedure criteria is as follows:

Table 3: Allocation procedure criteria

Revenue classification	Revenue contribution	Allocation type
Very low	Processes generating overall revenue of the order of 1% or less	The process may be neglected
High	A difference in revenue of more than 25%	Allocation shall be based on economic values
Low	A difference in revenue of less than 25%	Allocation shall be based on physical properties, e.g. mass, volume.

Material flow carrying specific inherent properties, e.g. energy content, elementary composition, shall always be allocated reflecting the physical flows, irrespective of the allocation chosen for the process. In the case of combined heat and power production, a distribution based on the best efficiency for the (potential) separate generation of electricity or heat shall be considered.

Data provided by Downer for this assessment includes both product (recycled content in mixes) and production site (energy use) specific data.

The following allocation sections explain the allocations made in this EPD.

Allocation of recycled content in toner, plastic (Toner-Plas) and recycled asphalt paving (RAP)

Downer's Reconophalt mixes incorporate varying levels of toner-plas, crushed glass and RAP. Based on the guidelines from PCR for Asphalt mixtures (EPD Australasia , 2019), the transportation and processing impacts for recycled materials have been allocated to Downer. However, impacts from raw materials and extraction have been excluded as these are secondary waste materials. Transport emissions have been considered for toner-plas and crushed glass. The waste toner and plastic are collected by Close the Loop in Melbourne and utilised to make the toner+plastic additive for asphalt. The glass is collected by Suez spring farm. Impacts associated with the process involved in preparing the recycled materials for use in asphalt mixture occurring within the mixing plant have also been considered as per the PCR for Asphalt mixtures. If toner, plastic, crushed glass and RAP were not utilised for making the additive and substituting aggregates these materials would otherwise have been landfilled and hence are classified as waste.

Allocation for waste handling

According to the PCR for Asphalt mixtures (EPD Australasia , 2019), treatment of wastes generated by the activities included in the system boundaries should be included in the LCA calculation. Therefore, waste treatment has been included in line with the Asphalt mixtures PCR and the "polluter pays principle". Refer to section 4.1.1 for waste processing details.

Allocation for energy used in manufacturing

Based on the guidelines of Australasian Appendix to PCR for Asphalt Mixtures (v2019-01-22), Method B is used for allocation of energy used in manufacturing of Reconophalt, wherein energy consumption of the plant is allocated equally across all products (by mass).

Background data

The allocation approach for the generic databases utilised in this LCA is also compliant with the PCR. More specifically, the burden of primary production of materials is always allocated to the primary user of a material, while secondary (recycled) materials bear only the impacts of the recycling processes.

Compliance with standards

The LCA and EPD have been developed to comply with:

- ISO 14040:2006 and ISO14044:2006+A1:2018 which describe the principles, framework, requirements and provides guidelines for life cycle assessment (LCA) (ISO, 2006; ISO, 2018).5-6
- ISO 14025:2006 Environmental labels and declarations – Type III environmental declarations -- Principles and procedures, which establishes the principles and specifies the procedures for developing Type III environmental declaration programmes and Type III environmental declarations (ISO, 2006).7
- General Programme Instructions (GPI) for the International EPD System V3.01 – containing instructions regarding methodology and the content that must be included in EPDs registered under the International EPD System.8
- Instructions of EPD Australasia V3.0 – a regional annex to the general programme instructions of the International EPD System.9
- PCR 2018:04 Asphalt mixtures (Version 1.03), 2019-09-0610
- Australian Appendix PCR Asphalt mixtures (Version: 2019-01-22)11

Key assumptions

- All foreground data used for the manufacturing processes (up to factory gate), transportation to the asphalt plant, distribution, installation in Australia, deconstruction, transport and waste processing was collected from Downer via a 'Request for Information' spreadsheet. This data was collected for the period May 2020 to April 2021 referred as financial year 2020 -2021 (FY20-21).
- For transport from construction site, the average distance of past construction jobs and tonnes of asphalt used per job by Downer was considered.
- All processes required for processing of RAP are covered in waste processing (module C3) and no material is taken for landfill or energy recovery. Hence the impacts for disposal (module C4) are considered to be zero.

Content declaration

EPD Product description

Five Reconophalt mixes with varying RAP and crushed glass content have been included in this EPD (see Table 4)

Table 4: Reconophalt mixes included in this EPD

Product type	Mix name	Glass content	RAP content
Asphalt	AC14H A15E	2.50%	10%
	AC14H AR450	2.50%	20%
	AC14 AR450	2.50%	30%
	AC20 AR450A	0%	30%
	AC20 AR450	10%	30%

The material composition for each of these mixes is shown in Table 5 and a graphical representation example of materials distribution for the AC14H A15E mix is depicted in Figure 2.

Figure 2: Materials distribution for AC14 C170 R50 mix

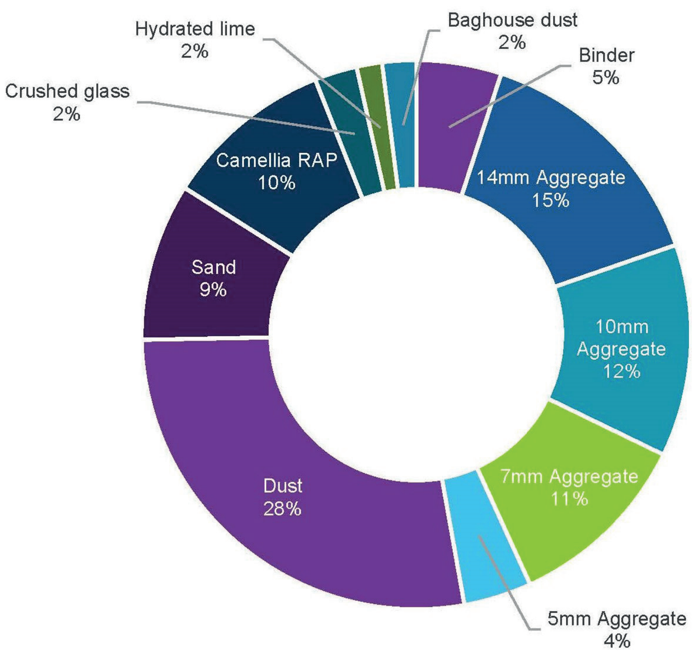


Table 5: Materials used for manufacturing for Mix AC14H A15E, AC14H AR450, AC14 AR450, AC20 AR450 A and AC20 AR450 (per tonne of asphalt)

Material	AC14H A15E	AC14H AR450	AC14 AR450	AC20 AR450 A	AC20 AR450
Binder	0.0500	0.0430	0.0380	0.0370	0.0370
20mm Aggregate	-	-	-	0.1780	0.1770
14mm Aggregate	0.147	0.140	0.126	0.106	0.116
10mm Aggregate	0.125	0.101	0.116	0.089	0.085
7mm Aggregate	0.110	0.102	0.113	0.079	0.073
5mm Aggregate	0.0400	0.0350	-	-	-
Dust	0.275	0.253	0.191	0.128	0.092
Sand	0.0930	0.0700	0.0680	-	-
Camellia RAP	0.100	0.200	0.300	0.300	0.300
Crushed glass	0.0250	0.0250	0.0250	-	0.100
Hydrated lime	0.0150	0.0150	-	-	0.0150
Baghouse dust	0.0200	0.0150	0.0150	0.0200	0.0050
Toner-plas	-	-	0.00800	-	-
Reconomy sand	-	-	-	0.0630	-

All materials used in manufacturing of Reconophalt are delivered in bulk via trucks and no packaging material is involved.

Table 6: Utilities used for manufacturing for Mix AC14H A15E, AC14H AR450, AC14 AR450, AC20 AR450 A and AC20 AR450 (per tonne of asphalt)

Utiliies	AC14H A15E	AC14H AR450	AC14 AR450	AC20 AR450 A	AC20 AR450
Electricity (kWh/tonne)	6.23	6.23	6.23	6.23	6.23
Gas (MJ/tonne)	269	269	269	269	269
Diesel (L/tonne)	0.175	0.175	0.175	0.175	0.175

Recycled material

The RAP, crushed glass and Reconomy sand used for manufacturing have recycled content of 100%. Tonerplas contains 50% recycled soft plastics and 50% toner waste (100% total recycled content).

Since Downer makes its own RAP, crushed glass and Reconomy sand from the end-of-life asphalt materials, the RAP processing is included in module C4 and not A1.

This has been done to align with the PCR for Asphalt mixtures (EPD Australasia , 2019), which states that processes which are part of the waste processing in the previous product system should not be included in A1, referring to the "polluter pays" principle.

Environmental performance

Environmental performance related information

The potential environmental impacts, use of resources and waste categories included in this EPD were calculated using the SimaPro v9.1.1.1 tool and are listed in Table 5 . All tables from this point will contain the abbreviation only.

The LCA results are relative expressions and do not predict impacts on category endpoints, the exceeding of thresholds and safety margins or risks. The impact assessment results are presented in the next sections.

Table 7: Life Cycle Impact, Resource and waste Assessment Categories, Measurements and Methods

Impact Category	Abbreviation	Measurement Unit	Assessment Method and Implementation
Potential Environmental Impacts			
Global warming potential (fossil)	GWPF	kg CO2 equivalents (GWP100)	Baseline model of 100 years of the IPCC based on IPCC 2013
Global warming potential (biogenic)	GWPB	kg CO2 equivalents (GWP100)	Baseline model of 100 years of the IPCC based on IPCC 2013
Global warming potential (land use/ land transformation)	GWPL	kg CO2 equivalents (GWP100)	Baseline model of 100 years of the IPCC based on IPCC 2013
Total global warming potential	GWPT	kg CO2 equivalents (GWP100)	Baseline model of 100 years of the IPCC based on IPCC 2013
Acidification potential	AP	kg SO2 equivalents	Accumulated Exceedance, Seppälä et al. 2006, Posch et al., 2008
Eutrophication – aquatic freshwater	EP - freshwater	kg PO43- equivalents	CML (v4.7)
Photochemical ozone creation potential	POCP	kg C2H4	LOTOS-EUROS, Van Zelm et al., 2008, as applied in ReCiPe
Abiotic depletion potential (elements)	ADPE	equivalents	CML (v4.7)
Abiotic depletion potential (fossil fuels)	ADPF	kg Sb equivalents	CML (v4.7) -
Ozone depletion potential	ODP	MJ net calorific value	Steady-state ODPs, WMO 2014
Resource use			
Use of renewable primary ener-gy excluding renewable primary energy resources used as raw materials	PERE	MJ, net calorific value	ecoinvent version 3.8 and ex-panded by PRé Consultants [1 2]
Use of renewable primary ener-gy resources used as raw mate-rials	PERM	MJ, net calorific value	Manual for direct inputs [3]

[1] Method to calculate Cumulative Energy Demand (CED), based on the method published by Ecoinvent version 2.0 and expanded by PRé Consultants for raw materials available in the SimaPro database.

[2] Calculated as sum of Renewable, biomass, Renewable, wind, solar, geothermal and Renewable, water.

[3] Calculated based on the lower heating value of renewable raw materials.

Impact Category	Abbreviation	Measurement Unit	Assessment Method and Implementation
Total use of renewable primary energy resources (primary energy and primary energy resources used as raw materials)	PERT	MJ, net calorific value	ecoinvent version 3.8 and ex-panded by PRé Consultants
Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials	PENRE	MJ, net calorific value	Manual for direct inputs [4]
Use of non- renewable primary energy resources used as raw materials	PENRM	MJ, net calorific value	ecoinvent version 3.8 and ex-panded by PRé Consultants
Total use of non- renewable primary energy resources (primary energy and primary energy resources used as raw materials)	PENRT	MJ, net calorific value	ecoinvent version 3.8 and ex-panded by PRé Consultants [5]
Use of secondary material	SM	kg	Manual for direct inputs
Use of renewable secondary fuels	RSF	MJ, net calorific value	Manual for direct inputs
Use of non-renewable secondary fuels	NRSF	MJ, net calorific value	Manual for direct inputs
Use of net fresh water	FW	m3	ReCiPe 2016
Waste categories			
Hazardous waste disposed	HWD	kg	EDIP 2003 (v1.05)
Non-hazardous waste disposed	NHWD	kg	EDIP 2003 (v1.05) [6]
Radioactive waste dis-posed/ stored	RWD	kg	EDIP 2003 (v1.05)
Output flows			
Components for reuse	CRU	kg	Manual for direct inputs
Materials for recycling	MFR	kg	Manual for direct inputs
Materials for energy recovery	MFRE	kg	Manual for direct inputs
Exported energy	EE	MJ per energy carrier	Manual for direct inputs

[4] Calculated based on the higher heating value of non-renewable raw materials.

[5] Calculated as sum of Non-renewable, fossil, Non-renewable, nuclear and Non-renewable, biomass.

[6] Calculated as sum of Bulk waste and Slags/ash

Environmental performance results – modules A1 to B4

Product stage (A1-A3) results per tonne of asphalt

Environmental impact

Table 8: Mix AC14H A15E, AC14H AR450, AC14 AR450, AC20 AR450 A and AC20 AR450 environmental impact A1-A3 per tonne of asphalt: EPD Potential Environmental Impacts

Mix name	GWP - F	GWP - B	GWP - Luluc	GWP - T	AP	EP-fw	POCP	ADPE	ADPF	ODP
	kg CO_2 eq	kg CO_2 eq	kg CO_2 eq	kg CO_2 eq	kg SO_2 eq.	kg PO_4^{3-}-eq.	kg C_2H_4 eq.	kg Sb eq.	MJ	kg CFC11 eq.
AC14H A15E	9.07E+01	-2.23E-01	-5.92E-05	9.05E+01	3.92E-01	6.06E-02	2.54E-02	1.13E-04	3.15E+03	3.25E-05
AC14H AR450	8.35E+01	-2.34E-01	-1.55E-04	8.33E+01	3.45E-01	5.39E-02	2.25E-02	9.84E-05	2.77E+03	2.82E-05
AC14 AR450	6.81E+01	-2.41E-01	-2.32E-04	6.78E+01	3.01E-01	4.80E-02	1.84E-02	8.90E-05	2.45E+03	2.41E-05
AC20 AR450 A	6.29E+01	6.00E-02	5.11E-04	6.30E+01	2.80E-01	4.33E-02	1.77E-02	8.00E-05	2.36E+03	2.31E-05
AC20 AR450	7.50E+01	-1.16E+00	-2.56E-03	7.39E+01	2.92E-01	4.58E-02	1.85E-02	8.12E-05	2.42E+03	2.42E-05

Resource use

Table 9: Mix AC14H A15E, AC14H AR450, AC14 AR450, AC20 AR450 A and AC20 AR450 environmental impact A1-A3 per tonne of asphalt: EPD resource parameters

Mix name	PERE	PERM	PERT	PENRE	PENRM	PENRT	SM	RSF	NRSF	FW
	MJ	MJ	MJ	MJ	MJ	MJ	kg	MJ	MJ	m^3
AC14H A15E	2.18E+01	0.00E+00	2.18E+01	3.32E+03	2.03E+03	5.35E+03	1.46E+02	0.00E+00	0.00E+00	1.71E+00
AC14H AR450	2.00E+01	0.00E+00	2.00E+01	2.92E+03	1.75E+03	4.67E+03	2.42E+02	0.00E+00	0.00E+00	1.46E+00
AC14 AR450	1.64E+01	0.00E+00	1.64E+01	2.57E+03	1.55E+03	4.13E+03	3.51E+02	0.00E+00	0.00E+00	1.28E+00
AC20 AR450 A	1.54E+01	0.00E+00	1.54E+01	2.48E+03	1.51E+03	3.99E+03	3.87E+02	0.00E+00	0.00E+00	1.21E+00
AC20 AR450	1.80E+01	0.00E+00	1.80E+01	2.55E+03	1.51E+03	4.06E+03	4.09E+02	0.00E+00	0.00E+00	1.16E+00

Waste categories

Table 10: Mix AC14H A15E, AC14H AR450, AC14 AR450, AC20 AR450 A and AC20 AR450 environmental impact A1-A3 per tonne of asphalt: EPD waste categories

Mix name	HWD	NHWD	RWD
	kg	kg	kg
AC14H A15E	1.35E-03	5.56E+00	-7.61E-06
AC14H AR450	1.17E-03	4.79E+00	-8.10E-06
AC14 AR450	1.04E-03	4.54E+00	-8.55E-06
AC20 AR450 A	9.84E-04	4.51E+00	3.31E-06
AC20 AR450	9.86E-04	2.44E+00	-4.51E-05

Output flows

Table 11: Mix AC14H A15E, AC14H AR450, AC14 AR450, AC20 AR450 A and AC20 AR450 environmental impact A1-A3 per tonne of asphalt: Output flow categories

Mix name	CRU	MFR	MFER	EE
	kg	kg	kg	MJ per energy carrier
AC14H A15E	0.00E+00	1.00E+01	0.00E+00	0.00E+00
AC14H AR450	0.00E+00	1.00E+01	0.00E+00	0.00E+00
AC14 AR450	0.00E+00	1.00E+01	0.00E+00	0.00E+00
AC20 AR450 A	0.00E+00	1.00E+01	0.00E+00	0.00E+00
AC20 AR450	0.00E+00	1.00E+01	0.00E+00	0.00E+00

Environmental performance results for Scenario 1 – modules C1 to D

Scenario 1 assumes that at the end-of-life of the road i.e. 40 years, the asphalt is left as is and no deconstruction occurs. The only deconstruction occurring in this scenario is during the complete replacement of asphalt at 20 years.

Results for removal of asphalt (C1) per tonne of asphalt in scenario 1

Environmental impact

Table 12: Mix AC14H A15E, AC14H AR450, AC14 AR450, AC20 AR450 A and AC20 AR450 environmental impact C1 per tonne of asphalt: EPD potential Environmental Impacts

Mix name	GWP - F	GWP - B	GWP - Luluc	GWP - T	AP	EP-fw	POCP	ADPE	ADPF	ODP
	kg CO_2 eq	kg CO_2 eq	kg CO_2 eq	kg CO_2 eq	kg SO_2 eq.	kg PO_4^{3-}-eq.	kg C_2H_4 eq.	kg Sb eq.	MJ	kg CFC11 eq.
AC14H A15E	3.28E+00	9.14E-04	8.61E-06	3.28E+00	2.39E-02	5.29E-03	2.36E-02	6.74E-07	4.31E+01	4.81E-07
AC14H AR450	3.28E+00	9.14E-04	8.61E-06	3.28E+00	2.39E-02	5.29E-03	2.36E-02	6.74E-07	4.31E+01	4.81E-07
AC14 AR450	3.28E+00	9.14E-04	8.61E-06	3.28E+00	2.39E-02	5.29E-03	2.36E-02	6.74E-07	4.31E+01	4.81E-07
AC20 AR450 A	3.28E+00	9.14E-04	8.61E-06	3.28E+00	2.39E-02	5.29E-03	2.36E-02	6.74E-07	4.31E+01	4.81E-07
AC20 AR450	3.28E+00	9.14E-04	8.61E-06	3.28E+00	2.39E-02	5.29E-03	2.36E-02	6.74E-07	4.31E+01	4.81E-07

Resource use

Table 13: Mix AC14H A15E, AC14H AR450, AC14 AR450, AC20 AR450 A and AC20 AR450 environmental impact C1 per tonne of asphalt: EPD resource parameters

Mix name	PERE	PERM	PERT	PENRE	PENRM	PENRT	SM	RSF	NRSF	FW
	MJ	MJ	MJ	MJ	MJ	MJ	kg	MJ	MJ	m^3
AC14H A15E	1.35E-01	0.00E+00	1.35E-01	4.56E+01	0.00E+00	4.56E+01	0.00E+00	0.00E+00	0.00E+00	1.84E-02
AC14H AR450	1.35E-01	0.00E+00	1.35E-01	4.56E+01	0.00E+00	4.56E+01	0.00E+00	0.00E+00	0.00E+00	1.84E-02
AC14 AR450	1.35E-01	0.00E+00	1.35E-01	4.56E+01	0.00E+00	4.56E+01	0.00E+00	0.00E+00	0.00E+00	1.84E-02
AC20 AR450 A	1.35E-01	0.00E+00	1.35E-01	4.56E+01	0.00E+00	4.56E+01	0.00E+00	0.00E+00	0.00E+00	1.84E-02
AC20 AR450	1.35E-01	0.00E+00	1.35E-01	4.56E+01	0.00E+00	4.56E+01	0.00E+00	0.00E+00	0.00E+00	1.84E-02

Waste categories

Table 14: Mix AC14H A15E, AC14H AR450, AC14 AR450, AC20 AR450 A and AC20 AR450 environmental impact C1 per tonne of asphalt: EPD waste categories

Mix name	HWD	NHWD	RWD
	kg	kg	kg
AC14H A15E	1.99E-05	3.90E-02	1.45E-07
AC14H AR450	1.99E-05	3.90E-02	1.45E-07
AC14 AR450	1.99E-05	3.90E-02	1.45E-07
AC20 AR450 A	1.99E-05	3.90E-02	1.45E-07
AC20 AR450	1.99E-05	3.90E-02	1.45E-07

Output flows

Table 15: Mix AC14H A15E, AC14H AR450, AC14 AR450, AC20 AR450 A and AC20 AR450 environmental impact C1 per tonne of asphalt: EPD output flow categories

Mix name	CRU	MFR	MFER	EE
	kg	kg	kg	MJ per energy carrier
AC14H A15E	0.00E+00	0.00E+00	0.00E+00	0.00E+00
AC14H AR450	0.00E+00	0.00E+00	0.00E+00	0.00E+00
AC14 AR450	0.00E+00	0.00E+00	0.00E+00	0.00E+00
AC20 AR450 A	0.00E+00	0.00E+00	0.00E+00	0.00E+00
AC20 AR450	0.00E+00	0.00E+00	0.00E+00	0.00E+00

6.3.2 Results for transport to Camellia (C2) per tonne of asphalt in scenario 1

Environmental impact

Table 16: Mix AC14H A15E, AC14H AR450, AC14 AR450, AC20 AR450 A and AC20 AR450 environmental impact C2 per tonne of asphalt: EPD potential environmental impacts

Mix name	GWP - F	GWP - B	GWP - Luluc	GWP - T	AP	EP-fw	POCP	ADPE	ADPF	ODP
	kg CO_2 eq	kg CO_2 eq	kg CO_2 eq	kg CO_2 eq	kg SO_2 eq.	kg PO_4^{3-}-eq.	kg C_2H_4 eq.	kg Sb eq.	MJ	kg CFC11 eq.
AC14H A15E	4.93E+00	2.43E-04	4.05E-05	4.93E+00	2.05E-02	4.68E-03	2.96E-02	1.77E-05	6.61E+01	7.44E-07
AC14H AR450	4.93E+00	2.43E-04	4.05E-05	4.93E+00	2.05E-02	4.68E-03	2.96E-02	1.77E-05	6.61E+01	7.44E-07
AC14 AR450	4.93E+00	2.43E-04	4.05E-05	4.93E+00	2.05E-02	4.68E-03	2.96E-02	1.77E-05	6.61E+01	7.44E-07
AC20 AR450 A	4.93E+00	2.43E-04	4.05E-05	4.93E+00	2.05E-02	4.68E-03	2.96E-02	1.77E-05	6.61E+01	7.44E-07
AC20 AR450	4.93E+00	2.43E-04	4.05E-05	4.93E+00	2.05E-02	4.68E-03	2.96E-02	1.77E-05	6.61E+01	7.44E-07

Resource use

Table 17: Mix AC14H A15E, AC14H AR450, AC14 AR450, AC20 AR450 A and AC20 AR450 environmental impact C2 per tonne of asphalt: EPD resource parameters

Mix name	PERE	PERM	PERT	PENRE	PENRM	PENRT	SM	RSF	NRSF	FW
	MJ	MJ	MJ	MJ	MJ	MJ	kg	MJ	MJ	m^3
AC14H A15E	7.18E-01	0.00E+00	7.18E-01	6.98E+01	0.00E+00	6.98E+01	0.00E+00	0.00E+00	0.00E+00	2.49E-02
AC14H AR450	7.18E-01	0.00E+00	7.18E-01	6.98E+01	0.00E+00	6.98E+01	0.00E+00	0.00E+00	0.00E+00	2.49E-02
AC14 AR450	7.18E-01	0.00E+00	7.18E-01	6.98E+01	0.00E+00	6.98E+01	0.00E+00	0.00E+00	0.00E+00	2.49E-02
AC20 AR450 A	7.18E-01	0.00E+00	7.18E-01	6.98E+01	0.00E+00	6.98E+01	0.00E+00	0.00E+00	0.00E+00	2.49E-02
AC20 AR450	7.18E-01	0.00E+00	7.18E-01	6.98E+01	0.00E+00	6.98E+01	0.00E+00	0.00E+00	0.00E+00	2.49E-02

Waste Categories

Table 18: Mix AC14H A15E, AC14H AR450, AC14 AR450, AC20 AR450 A and AC20 AR450 environmental impact C2 per tonne of asphalt: EPD waste categories

Mix name	HWD	NHWD	RWD
	kg	kg	kg
AC14H A15E	9.15E-05	4.83E-01	3.64E-07
AC14H AR450	9.15E-05	4.83E-01	3.64E-07
AC14 AR450	9.15E-05	4.83E-01	3.64E-07
AC20 AR450 A	9.15E-05	4.83E-01	3.64E-07
AC20 AR450	9.15E-05	4.83E-01	3.64E-07

Output flows

Table 19: Mix AC14H A15E, AC14H AR450, AC14 AR450, AC20 AR450 A and AC20 AR450 environmental impact C2 per tonne of asphalt: EPD output flow categories

Mix name	CRU	MFR	MFER	EE
	kg	kg	kg	MJ per energy carrier
AC14H A15E	0.00E+00	0.00E+00	0.00E+00	0.00E+00
AC14H AR450	0.00E+00	0.00E+00	0.00E+00	0.00E+00
AC14 AR450	0.00E+00	0.00E+00	0.00E+00	0.00E+00
AC20 AR450 A	0.00E+00	0.00E+00	0.00E+00	0.00E+00
AC20 AR450	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Results for waste processing (C3) per tonne of asphalt in scenario 1

Environmental impact

Table 20: Mix AC14H A15E, AC14H AR450, AC14 AR450, AC20 AR450 A and AC20 AR450 environmental impact C3 per tonne of asphalt: EPD potential environmental impacts

Mix name	GWP - F	GWP - B	GWP - Luluc	GWP - T	AP	EP-fw	POCP	ADPE	ADPF	ODP
	kg CO_2 eq	kg CO_2 eq	kg CO_2 eq	kg CO_2 eq	kg SO_2 eq.	kg PO_4^{3-}-eq.	kg C_2H_4 eq.	kg Sb eq.	MJ	kg CFC11 eq.
AC14H A15E	2.14E+00	5.45E-04	5.59E-06	2.14E+00	1.56E-02	3.45E-03	1.00E+03	4.38E-07	2.81E+01	3.14E-07
AC14H AR450	2.14E+00	5.45E-04	5.59E-06	2.14E+00	1.56E-02	3.45E-03	1.00E+03	4.38E-07	2.81E+01	3.14E-07
AC14 AR450	2.14E+00	5.45E-04	5.59E-06	2.14E+00	1.56E-02	3.45E-03	1.00E+03	4.38E-07	2.81E+01	3.14E-07
AC20 AR450 A	2.14E+00	5.45E-04	5.59E-06	2.14E+00	1.56E-02	3.45E-03	1.00E+03	4.38E-07	2.81E+01	3.14E-07
AC20 AR450	2.14E+00	5.45E-04	5.59E-06	2.14E+00	1.56E-02	3.45E-03	1.00E+03	4.38E-07	2.81E+01	3.14E-07

Resource use

Table 21: Mix AC14H A15E, AC14H AR450, AC14 AR450, AC20 AR450 A and AC20 AR450 environmental impact C3 per tonne of asphalt: EPD resource parameters

Mix name	PERE	PERM	PERT	PENRE	PENRM	PENRT	SM	RSF	NRSF	FW
	MJ	MJ	MJ	MJ	MJ	MJ	kg	MJ	MJ	m^3
AC14H A15E	8.68E-02	0.00E+00	8.68E-02	2.98E+01	0.00E+00	2.98E+01	0.00E+00	0.00E+00	0.00E+00	9.84E-03
AC14H AR450	8.68E-02	0.00E+00	8.68E-02	2.98E+01	0.00E+00	2.98E+01	0.00E+00	0.00E+00	0.00E+00	9.84E-03
AC14 AR450	8.68E-02	0.00E+00	8.68E-02	2.98E+01	0.00E+00	2.98E+01	0.00E+00	0.00E+00	0.00E+00	9.84E-03
AC20 AR450 A	8.68E-02	0.00E+00	8.68E-02	2.98E+01	0.00E+00	2.98E+01	0.00E+00	0.00E+00	0.00E+00	9.84E-03
AC20 AR450	8.68E-02	0.00E+00	8.68E-02	2.98E+01	0.00E+00	2.98E+01	0.00E+00	0.00E+00	0.00E+00	9.84E-03

Waste Categories

Table 22: Mix AC14H A15E, AC14H AR450, AC14 AR450, AC20 AR450 A and AC20 AR450 environmental impact C3 per tonne of asphalt: EPD waste categories

Mix name	HWD	NHWD	RWD
	kg	kg	kg
AC14H A15E	1.30E-05	2.54E-02	9.47E-08
AC14H AR450	1.30E-05	2.54E-02	9.47E-08
AC14 AR450	1.30E-05	2.54E-02	9.47E-08
AC20 AR450 A	1.30E-05	2.54E-02	9.47E-08
AC20 AR450	1.30E-05	2.54E-02	9.47E-08

Output flows

Table 23: Mix AC14H A15E, AC14H AR450, AC14 AR450, AC20 AR450 A and AC20 AR450 environmental impact C3 per tonne of asphalt: EPD output flow categories

Mix name	CRU	MFR	MFER	EE
	kg	kg	kg	MJ per energy carrier
AC14H A15E	0.00E+00	1.00E+03	0.00E+00	0.00E+00
AC14H AR450	0.00E+00	1.00E+03	0.00E+00	0.00E+00
AC14 AR450	0.00E+00	1.00E+03	0.00E+00	0.00E+00
AC20 AR450 A	0.00E+00	1.00E+03	0.00E+00	0.00E+00
AC20 AR450	0.00E+00	1.00E+03	0.00E+00	0.00E+00

Results for waste disposal (C4) per tonne of asphalt in scenario 1

All waste from construction site goes to Camellia for recycling into RAP. No waste goes to landfill or any other disposal avenue. Hence C4 impacts are zero. Waste processing impacts are covered in C3.

Environmental impact

Table 24: Mix AC14H A15E, AC14H AR450, AC14 AR450, AC20 AR450 A and AC20 AR450 environmental impact C4 per tonne of asphalt: EPD potential environmental impacts

Mix name	GWP - F	GWP - B	GWP - Luluc	GWP - T	AP	EP-fw	POCP	ADPE	ADPF	ODP
	kg CO_2 eq	kg CO_2 eq	kg CO_2 eq	kg CO_2 eq	kg SO_2 eq.	kg PO_4^{3-}-eq.	kg C_2H_4 eq.	kg Sb eq.	MJ	kg CFC11 eq.
AC14H A15E	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
AC14H AR450	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
AC14 AR450	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
AC20 AR450 A	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
AC20 AR450	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Resource use

Table 25: Mix AC14H A15E, AC14H AR450, AC14 AR450, AC20 AR450 and AC20 AR450 environmental impact C4 per tonne of asphalt: EPD resource parameters

Mix name	PERE	PERM	PERT	PENRE	PENRM	PENRT	SM	RSF	NRSF	FW
	MJ	MJ	MJ	MJ	MJ	MJ	kg	MJ	MJ	m^3
AC14H A15E	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
AC14H AR450	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
AC14 AR450	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
AC20 AR450 A	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
AC20 AR450	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Waste Categories

Table 26: Mix AC14H A15E, AC14H AR450, AC14 AR450, AC20 AR450 A and AC20 AR450 environmental impact C4 per tonne of asphalt: EPD waste categories

Mix name	HWD	NHWD	RWD
	kg	kg	kg
AC14H A15E	0.00E+00	0.00E+00	0.00E+00
AC14H AR450	0.00E+00	0.00E+00	0.00E+00
AC14 AR450	0.00E+00	0.00E+00	0.00E+00
AC20 AR450 A	0.00E+00	0.00E+00	0.00E+00
AC20 AR450	0.00E+00	0.00E+00	0.00E+00

Output flows

Table 27: Mix AC14H A15E, AC14H AR450, AC14 AR450, AC20 AR450 A and AC20 AR450 environmental impact C4 per tonne of asphalt: EPD output flow categories

Mix name	CRU	MFR	MFER	EE
	kg	kg	kg	MJ per energy carrier
AC14H A15E	0.00E+00	0.00E+00	0.00E+00	0.00E+00
AC14H AR450	0.00E+00	0.00E+00	0.00E+00	0.00E+00
AC14 AR450	0.00E+00	0.00E+00	0.00E+00	0.00E+00
AC20 AR450 A	0.00E+00	0.00E+00	0.00E+00	0.00E+00
AC20 AR450	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Benefits and loads beyond the system boundary (D) per tonne of asphalt in scenario 1

The results below are for scenario 1 which assumes that at the end-of-life of the road i.e. 40 years, the asphalt is left as is and no deconstruction occurs. The only deconstruction occurring in this scenario is during the complete replacement of asphalt at 20 years.

Environmental impact

Table 28: Mix AC14H A15E, AC14H AR450, AC14 AR450, AC20 AR450 A and AC20 AR450 environmental impact D per tonne of asphalt: potential environmental impacts

Mix name	GWP - F	GWP - B	GWP - Luluc	GWP - T	AP	EP-fw	POCP	ADPE	ADPF	ODP
	kg CO_2 eq	kg CO_2 eq	kg CO_2 eq	kg CO_2 eq	kg SO_2 eq.	kg PO_4^{3-}-eq.	kg C_2H_4 eq.	kg Sb eq.	MJ	kg CFC11 eq.
AC14H A15E	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
AC14H AR450	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
AC14 AR450	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
AC20 AR450 A	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
AC20 AR450	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Resource use

Table 29: Mix AC14H A15E, AC14H AR450, AC14 AR450, AC20 AR450 A and AC20 AR450 environmental impact D per tonne of asphalt: EPD resource parameters

Mix name	PERE	PERM	PERT	PENRE	PENRM	PENRT	SM	RSF	NRSF	FW
	MJ	MJ	MJ	MJ	MJ	MJ	kg	MJ	MJ	m^3
AC14H A15E	0.00E+00	0.00E+00	0.00E+00	0.00E+00	-3.08E+01	-3.08E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00
AC14H AR450	0.00E+00	0.00E+00	0.00E+00	0.00E+00	-3.08E+01	-3.08E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00
AC14 AR450	0.00E+00	0.00E+00	0.00E+00	0.00E+00	-3.08E+01	-3.08E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00
AC20 AR450 A	0.00E+00	0.00E+00	0.00E+00	0.00E+00	-3.08E+01	-3.08E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00
AC20 AR450	0.00E+00	0.00E+00	0.00E+00	0.00E+00	-3.08E+01	-3.08E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Waste Categories

Table 30: Mix AC14H A15E, AC14H AR450, AC14 AR450, AC20 AR450 A and AC20 AR450 environmental impact D per tonne of asphalt: EPD waste categories

Mix name	HWD	NHWD	RWD
	kg	kg	kg
AC14H A15E	0.00E+00	0.00E+00	0.00E+00
AC14H AR450	0.00E+00	0.00E+00	0.00E+00
AC14 AR450	0.00E+00	0.00E+00	0.00E+00
AC20 AR450 A	0.00E+00	0.00E+00	0.00E+00
AC20 AR450	0.00E+00	0.00E+00	0.00E+00

Output flows

Table 31: Mix AC14H A15E, AC14H AR450, AC14 AR450, AC20 AR450 A and AC20 AR450 environmental impact D per tonne of asphalt: EPD output flow categories

Mix name	CRU	MFR	MFER	EE
	kg	kg	kg	MJ per energy carrier
AC14H A15E	0.00E+00	0.00E+00	0.00E+00	0.00E+00
AC14H AR450	0.00E+00	0.00E+00	0.00E+00	0.00E+00
AC14 AR450	0.00E+00	0.00E+00	0.00E+00	0.00E+00
AC20 AR450 A	0.00E+00	0.00E+00	0.00E+00	0.00E+00
AC20 AR450	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Environmental performance results for Scenario 2 – modules C1 to D

Scenario 2 assumes that at the end-of-life of the road i.e. 40 years, deconstruction occurs and the asphalt removed is to be transported to Camellia for recycling into RAP. This means that in scenario 2, the deconstruction occurs twice i.e. once at 20 years and then at 40 years.

Results for removal of asphalt (C1) per tonne of asphalt in scenario 2

Environmental impact

Table 32: Mix AC14H A15E, AC14H AR450, AC14 AR450, AC20 AR450 A and AC20 AR450 environmental impact C1 per tonne of asphalt: EPD potential Environmental Impacts – Scenario 2

Mix name	GWP - F	GWP - B	GWP - Luluc	GWP - T	AP	EP-fw	POCP	ADPE	ADPF	ODP
	kg CO_2 eq	kg CO_2 eq	kg CO_2 eq	kg CO_2 eq	kg SO_2 eq.	kg PO_4^{3-}-eq.	kg C_2H_4 eq.	kg Sb eq.	MJ	kg CFC11 eq.
AC14H A15E	6.56E+00	1.83E-03	1.72E-05	6.56E+00	4.78E-02	1.06E-02	4.73E-02	1.35E-06	8.62E+01	9.62E-07
AC14H AR450	6.56E+00	1.83E-03	1.72E-05	6.56E+00	4.78E-02	1.06E-02	4.73E-02	1.35E-06	8.62E+01	9.62E-07
AC14 AR450	6.56E+00	1.83E-03	1.72E-05	6.56E+00	4.78E-02	1.06E-02	4.73E-02	1.35E-06	8.62E+01	9.62E-07
AC20 AR450 A	6.56E+00	1.83E-03	1.72E-05	6.56E+00	4.78E-02	1.06E-02	4.73E-02	1.35E-06	8.62E+01	9.62E-07
AC20 AR450	6.56E+00	1.83E-03	1.72E-05	6.56E+00	4.78E-02	1.06E-02	4.73E-02	1.35E-06	8.62E+01	9.62E-07

Resource use

Table 33: Mix AC14H A15E, AC14H AR450, AC14 AR450, AC20 AR450 A and AC20 AR450 environmental impact C1 per tonne of asphalt: EPD resource parameters – Scenario 2

Mix name	PERE	PERM	PERT	PENRE	PENRM	PENRT	SM	RSF	NRSF	FW
	MJ	MJ	MJ	MJ	MJ	MJ	kg	MJ	MJ	m^3
AC14H A15E	2.70E-01	0.00E+00	2.70E-01	9.13E+01	0.00E+00	9.13E+01	0.00E+00	0.00E+00	0.00E+00	3.67E-02
AC14H AR450	2.70E-01	0.00E+00	2.70E-01	9.13E+01	0.00E+00	9.13E+01	0.00E+00	0.00E+00	0.00E+00	3.67E-02
AC14 AR450	2.70E-01	0.00E+00	2.70E-01	9.13E+01	0.00E+00	9.13E+01	0.00E+00	0.00E+00	0.00E+00	3.67E-02
AC20 AR450 A	2.70E-01	0.00E+00	2.70E-01	9.13E+01	0.00E+00	9.13E+01	0.00E+00	0.00E+00	0.00E+00	3.67E-02
AC20 AR450	2.70E-01	0.00E+00	2.70E-01	9.13E+01	0.00E+00	9.13E+01	0.00E+00	0.00E+00	0.00E+00	3.67E-02

Waste Categories

Table 34: Mix AC14H A15E, AC14H AR450, AC14 AR450, AC20 AR450 A and AC20 AR450 environmental impact C1 per tonne of asphalt: EPD waste categories – Scenario 2

Mix name	HWD	NHWD	RWD
	kg	kg	kg
AC14H A15E	0.00E+00	0.00E+00	0.00E+00
AC14H AR450	0.00E+00	0.00E+00	0.00E+00
AC14 AR450	0.00E+00	0.00E+00	0.00E+00
AC20 AR450 A	0.00E+00	0.00E+00	0.00E+00
AC20 AR450	0.00E+00	0.00E+00	0.00E+00

Output flows

Table 35: Mix AC14H A15E, AC14H AR450, AC14 AR450, AC20 AR450 A and AC20 AR450 environmental impact C1 per tonne of asphalt: EPD output flow categories – Scenario 2

Mix name	CRU	MFR	MFER	EE
	kg	kg	kg	MJ per energy carrier
AC14H A15E	0.00E+00	0.00E+00	0.00E+00	0.00E+00
AC14H AR450	0.00E+00	0.00E+00	0.00E+00	0.00E+00
AC14 AR450 A	0.00E+00	0.00E+00	0.00E+00	0.00E+00
AC20 AR450	0.00E+00	0.00E+00	0.00E+00	0.00E+00
AC20 AR450	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Results for transport of waste to Camellia (C2) per tonne of asphalt in scenario 2

Environmental impact

Table 36: Mix AC14H A15E, AC14H AR450, AC14 AR450, AC20 AR450 A and AC20 AR450 environmental impact C2 per tonne of asphalt: EPD potential environmental impacts – Scenario 2

Mix name	GWP - F	GWP - B	GWP - Luluc	GWP - T	AP	EP-fw	POCP	ADPE	ADPF	ODP
	kg CO_2 eq	kg CO_2 eq	kg CO_2 eq	kg CO_2 eq	kg SO_2 eq.	kg PO_4^{3-}-eq.	kg C_2H_4 eq.	kg Sb eq.	MJ	kg CFC11 eq.
AC14H A15E	9.86E+00	4.86E-04	8.10E-05	9.86E+00	4.10E-02	9.36E-03	5.91E-02	3.54E-05	1.32E+02	1.49E-06
AC14H AR450	9.86E+00	4.86E-04	8.10E-05	9.86E+00	4.10E-02	9.36E-03	5.91E-02	3.54E-05	1.32E+02	1.49E-06
AC14 AR450	9.86E+00	4.86E-04	8.10E-05	9.86E+00	4.10E-02	9.36E-03	5.91E-02	3.54E-05	1.32E+02	1.49E-06
AC20 AR450	9.86E+00	4.86E-04	8.10E-05	9.86E+00	4.10E-02	9.36E-03	5.91E-02	3.54E-05	1.32E+02	1.49E-06
AC20 AR450	9.86E+00	4.86E-04	8.10E-05	9.86E+00	4.10E-02	9.36E-03	5.91E-02	3.54E-05	1.32E+02	1.49E-06

Resource use

Table 37: Mix AC14H A15E, AC14H AR450, AC14 AR450, AC20 AR450 A and AC20 AR450 environmental impact C2 per tonne of asphalt: EPD resource parameters – Scenario 2

Mix name	PERE	PERM	PERT	PENRE	PENRM	PENRT	SM	RSF	NRSF	FW
	MJ	MJ	MJ	MJ	MJ	MJ	kg	MJ	MJ	m^3
AC14H A15E	1.44E+00	0.00E+00	1.44E+00	1.40E+02	0.00E+00	1.40E+02	0.00E+00	0.00E+00	0.00E+00	4.98E-02
AC14H AR450	1.44E+00	0.00E+00	1.44E+00	1.40E+02	0.00E+00	1.40E+02	0.00E+00	0.00E+00	0.00E+00	4.98E-02
AC14 AR450	1.44E+00	0.00E+00	1.44E+00	1.40E+02	0.00E+00	1.40E+02	0.00E+00	0.00E+00	0.00E+00	4.98E-02
AC20 AR450	1.44E+00	0.00E+00	1.44E+00	1.40E+02	0.00E+00	1.40E+02	0.00E+00	0.00E+00	0.00E+00	4.98E-02
AC20 AR450	1.44E+00	0.00E+00	1.44E+00	1.40E+02	0.00E+00	1.40E+02	0.00E+00	0.00E+00	0.00E+00	4.98E-02

Waste Categories

Table 38: Mix AC14H A15E, AC14H AR450, AC14 AR450, AC20 AR450 A and AC20 AR450 environmental impact C2 per tonne of asphalt: EPD waste categories – Scenario 2

Mix name	HWD	NHWD	RWD
	kg	kg	kg
AC14H A15E	1.83E-04	9.65E-01	7.29E-07
AC14H AR450	1.83E-04	9.65E-01	7.29E-07
AC14 AR450	1.83E-04	9.65E-01	7.29E-07
AC20 AR450	1.83E-04	9.65E-01	7.29E-07
AC20 AR450	1.83E-04	9.65E-01	7.29E-07

Output flows

Table 39: Mix AC14H A15E, AC14H AR450, AC14 AR450, AC20 AR450 A and AC20 AR450 environmental impact C2 per tonne of asphalt: EPD output flow categories – Scenario 2

Mix name	CRU	MFR	MFER	EE
	kg	kg	kg	MJ per energy carrier
AC14H A15E	0.00E+00	0.00E+00	0.00E+00	0.00E+00
AC14H AR450	0.00E+00	0.00E+00	0.00E+00	0.00E+00
AC14 AR450	0.00E+00	0.00E+00	0.00E+00	0.00E+00
AC20 AR450 A	0.00E+00	0.00E+00	0.00E+00	0.00E+00
AC20 AR450	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Results for waste processing (C3) per tonne of asphalt in scenario 2

Environmental impact

Table 40: Mix AC14H A15E, AC14H AR450, AC14 AR450, AC20 AR450 A and AC20 AR450 environmental impact C3 per tonne of asphalt: EPD potential environmental impacts – Scenario 2

Mix name	GWP - F	GWP - B	GWP - Luluc	GWP - T	AP	EP-fw	POCP	ADPE	ADPF	ODP
	kg CO_2 eq	kg CO_2 eq	kg CO_2 eq	kg CO_2 eq	kg SO_2 eq.	kg PO_4^{3-}-eq.	kg C_2H_4 eq.	kg Sb eq.	MJ	kg CFC11 eq.
AC14H A15E	4.28E+00	1.09E-03	1.12E-05	4.28E+00	3.12E-02	6.89E-03	2.00E+03	8.76E-07	5.62E+01	6.27E-07
AC14H AR450	4.28E+00	1.09E-03	1.12E-05	4.28E+00	3.12E-02	6.89E-03	2.00E+03	8.76E-07	5.62E+01	6.27E-07
AC14 AR450	4.28E+00	1.09E-03	1.12E-05	4.28E+00	3.12E-02	6.89E-03	2.00E+03	8.76E-07	5.62E+01	6.27E-07
AC20 AR450 A	4.28E+00	1.09E-03	1.12E-05	4.28E+00	3.12E-02	6.89E-03	2.00E+03	8.76E-07	5.62E+01	6.27E-07
AC20 AR450	4.28E+00	1.09E-03	1.12E-05	4.28E+00	3.12E-02	6.89E-03	2.00E+03	8.76E-07	5.62E+01	6.27E-07

Resource use

Table 41: Mix AC14H A15E, AC14H AR450, AC14 AR450, AC20 AR450 A and AC20 AR450 environmental impact C3 per tonne of asphalt: EPD resource parameters – Scenario 2

Mix name	PERE	PERM	PERT	PENRE	PENRM	PENRT	SM	RSF	NRSF	FW
	MJ	MJ	MJ	MJ	MJ	MJ	kg	MJ	MJ	m^3
AC14H A15E	1.74E-01	0.00E+00	1.74E-01	5.95E+01	0.00E+00	5.95E+01	0.00E+00	0.00E+00	0.00E+00	1.97E-02
AC14H AR450	1.74E-01	0.00E+00	1.74E-01	5.95E+01	0.00E+00	5.95E+01	0.00E+00	0.00E+00	0.00E+00	1.97E-02
AC14 AR450	1.74E-01	0.00E+00	1.74E-01	5.95E+01	0.00E+00	5.95E+01	0.00E+00	0.00E+00	0.00E+00	1.97E-02
AC20 AR450 A	1.74E-01	0.00E+00	1.74E-01	5.95E+01	0.00E+00	5.95E+01	0.00E+00	0.00E+00	0.00E+00	1.97E-02
AC20 AR450	1.74E-01	0.00E+00	1.74E-01	5.95E+01	0.00E+00	5.95E+01	0.00E+00	0.00E+00	0.00E+00	1.97E-02

Waste Categories

Table 42: Mix AC14H A15E, AC14H AR450, AC14 AR450, AC20 AR450 A and AC20 AR450 environmental impact C3 per tonne of asphalt: EPD waste categories – Scenario 2

Mix name	HWD	NHWD	RWD
	kg	kg	kg
AC14H A15E	2.60E-05	5.07E-02	1.89E-07
AC14H AR450	2.60E-05	5.07E-02	1.89E-07
AC14 AR450	2.60E-05	5.07E-02	1.89E-07
AC20 AR450 A	2.60E-05	5.07E-02	1.89E-07
AC20 AR450	2.60E-05	5.07E-02	1.89E-07

Output flows

Table 43: Mix AC14H A15E, AC14H AR450, AC14 AR450, AC20 AR450 A and AC20 AR450 environmental impact C3 per tonne of asphalt: EPD output flow categories – Scenario 2

Mix name	CRU	MFR	MFER	EE
	kg	kg	kg	MJ per energy carrier
AC14H A15E	0.00E+00	2.00E+03	0.00E+00	0.00E+00
AC14H AR450	0.00E+00	2.00E+03	0.00E+00	0.00E+00
AC14 AR450	0.00E+00	2.00E+03	0.00E+00	0.00E+00
AC20 AR450 A	0.00E+00	2.00E+03	0.00E+00	0.00E+00
AC20 AR450	0.00E+00	1.92E+02	0.00E+00	0.00E+00

Results for waste disposal (C4) per tonne of asphalt in scenario 2

All waste from construction site goes to Camellia for recycling into RAP. No waste goes to landfill or any other disposal avenue. Hence C4 impacts are zero. Waste processing impacts are covered in C3.

Environmental impact

Table 44: Mix AC14H A15E, AC14H AR450, AC14 AR450, AC20 AR450 A and AC20 AR450 environmental impact C4 per tonne of asphalt: EPD potential environmental impacts – Scenario 2

Mix name	GWP - F	GWP - B	GWP - Luluc	GWP - T	AP	EP-fw	POCP	ADPE	ADPF	ODP
	kg CO_2 eq	kg CO_2 eq	kg CO_2 eq	kg CO_2 eq	kg SO_2 eq.	kg PO_4^{3-}-eq.	kg C_2H_4 eq.	kg Sb eq.	MJ	kg CFC11 eq.
AC14H A15E	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
AC14H AR450	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
AC14 AR450	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
AC20 AR450 A	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
AC20 AR450	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Resource use

Table 45: Mix AC14H A15E, AC14H AR450, AC14 AR450, AC20 AR450 A and AC20 AR450 environmental impact C4 per tonne of asphalt: EPD resource parameters – Scenario 2

Mix name	PERE	PERM	PERT	PENRE	PENRM	PENRT	SM	RSF	NRSF	FW
	MJ	MJ	MJ	MJ	MJ	MJ	kg	MJ	MJ	m^3
AC14H A15E	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
AC14H AR450	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
AC14 AR450	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
AC20 AR450 A	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
AC20 AR450	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Waste Categories

Table 46: Mix AC14H A15E, AC14H AR450, AC14 AR450, AC20 AR450 A and AC20 AR450 environmental impact C4 per tonne of asphalt: EPD waste categories – Scenario 2

Mix name	HWD	NHWD	RWD
	kg	kg	kg
AC14H A15E	0.00E+00	0.00E+00	0.00E+00
AC14H AR450	0.00E+00	0.00E+00	0.00E+00
AC14 AR450	0.00E+00	0.00E+00	0.00E+00
AC20 AR450 A	0.00E+00	0.00E+00	0.00E+00
AC20 AR450	0.00E+00	0.00E+00	0.00E+00

Output flows

Table 47: Mix AC14H A15E, AC14H AR450, AC14 AR450, AC20 AR450 A and AC20 AR450 environmental impact C4 per tonne of asphalt: EPD output flow categories – Scenario 2

Mix name	CRU	MFR	MFER	EE
	kg	kg	kg	MJ per energy carrier
AC14H A15E	0.00E+00	0.00E+00	0.00E+00	0.00E+00
AC14H AR450	0.00E+00	0.00E+00	0.00E+00	0.00E+00
AC14 AR450	0.00E+00	0.00E+00	0.00E+00	0.00E+00
AC20 AR450 A	0.00E+00	0.00E+00	0.00E+00	0.00E+00
AC20 AR450	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Benefits and loads beyond the system boundary (D) per tonne of asphalt in scenario 2

The results presented below are for scenario 2, which assumes that at the end-of-life of the road i.e. 40 years, deconstruction occurs and the asphalt removed is to be transported to Camellia for recycling into RAP. This means that in scenario 2, the deconstruction occurs twice i.e. once at 20 years and then at 40 years. Hence the benefits for scenario 2 will be higher than those in scenario 1.

Environmental impact

Table 48: Mix AC14H A15E, AC14H AR450, AC14 AR450, AC20 AR450 A and AC20 AR450 environmental impact D per tonne of asphalt: potential environmental impacts – Scenario 2

Mix name	GWP - F	GWP - B	GWP - Luluc	GWP - T	AP	EP-fw	POCP	ADPE	ADPF	ODP
	kg CO_2 eq	kg CO_2 eq	kg CO_2 eq	kg CO_2 eq	kg SO_2 eq.	kg PO_4^{3}-eq.	kg C_2H_4 eq.	kg Sb eq.	MJ	kg CFC11 eq.
AC14H A15E	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
AC14H AR450	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
AC14 AR450	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
AC20 AR450 A	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
AC20 AR450	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Resource use

Table 49: Mix AC14H A15E, AC14H AR450, AC14 AR450, AC20 AR450 A and AC20 AR450 environmental impact D per tonne of asphalt: EPD resource parameters – Scenario 2

Mix name	PERE	PERM	PERT	PENRE	PENRM	PENRT	SM	RSF	NRSF	FW
	MJ	MJ	MJ	MJ	MJ	MJ	kg	MJ	MJ	m^3
AC14H A15E	0.00E+00	0.00E+00	0.00E+00	0.00E+00	-6.16E+01	-6.16E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00
AC14H AR450	0.00E+00	0.00E+00	0.00E+00	0.00E+00	-6.16E+01	-6.16E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00
AC14 AR450	0.00E+00	0.00E+00	0.00E+00	0.00E+00	-6.16E+01	-6.16E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00
AC20 AR450 A	0.00E+00	0.00E+00	0.00E+00	0.00E+00	-6.16E+01	-6.16E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00
AC20 AR450	0.00E+00	0.00E+00	0.00E+00	0.00E+00	-6.16E+01	-6.16E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Waste Categories

Table 50: Mix AC14H A15E, AC14H AR450, AC14 AR450, AC20 AR450 A and AC20 AR450 environmental impact D per tonne of asphalt: EPD waste categories – Scenario 2

Mix name	HWD	NHWD	RWD
	kg	kg	kg
AC14H A15E	0.00E+00	0.00E+00	0.00E+00
AC14H AR450	0.00E+00	0.00E+00	0.00E+00
AC14 AR450	0.00E+00	0.00E+00	0.00E+00
AC20 AR450 A	0.00E+00	0.00E+00	0.00E+00
AC20 AR450	0.00E+00	0.00E+00	0.00E+00

Output flows

Table 51: Mix AC14H A15E, AC14H AR450, AC14 AR450, AC20 AR450 and AC20 AR450 environmental impact D per tonne of asphalt: EPD output flow categories – Scenario 2

Mix name	CRU	MFR	MFER	EE
	kg	kg	kg	MJ per energy carrier
AC14H A15E	0.00E+00	0.00E+00	0.00E+00	0.00E+00
AC14H AR450	0.00E+00	0.00E+00	0.00E+00	0.00E+00
AC14 AR450	0.00E+00	0.00E+00	0.00E+00	0.00E+00
AC20 AR450 A	0.00E+00	0.00E+00	0.00E+00	0.00E+00
AC20 AR450	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Interpretation of results

Across upstream, core and downstream, the product stage (module A1-A3) is the most significant contributor to potential environmental impacts accounting for 86-91% of the GWPF indicator.

In terms of resource use and across all modules (A1-D), the largest energy use comes from non-renewable primary energy resources (PENRT).

In terms of the life cycle stages, the product stage (module A1-A3) is the most significant contributor to the GWPF emissions, accounting for 86-91% of it.

In terms of waste and across all modules, almost a 100% of the waste disposed is non- hazardous waste (NHWD).

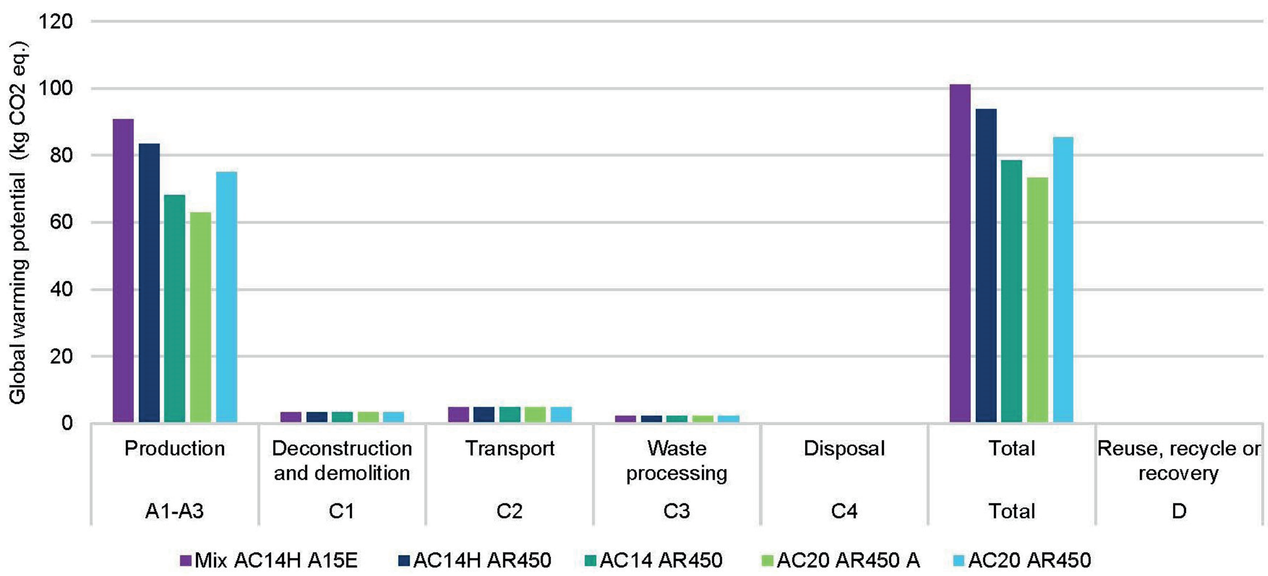
In terms of global warming potential biogenic (GWPB) across A1- C3, the negative contribution comes from the avoided impact of new aggregates production.

Overall, the AC20 AR450 A mix has the lowest impacts across most indicators of the five mixes except use of secondary material (SM). This is mainly because it uses Reconomy sand, it is one of the mixes with the highest RAP content and has no lime or toner-plas. Higher RAP content and the use of Reconomy sand reduces the amount of virgin bitumen required in the mix, thereby lowering the environmental impacts.

Furthermore, the RAP reduces the amount of aggregates, including dust and sand and their associated transport from quarries.

For the five mixes, the binder i.e. bitumen AR450 and A15E is the most significant contributor to the production stage GWPF emissions (25-30%), followed by gas used for manufacturing (18-26%) and aggregates transport (12-19%).

Figure 3: GWPF for modules A1-D (per tonne) for Reconophalt mixes included in this EPD



Acronyms

ADPE	Abiotic Depletion Potential (Elements)
ADPF	Abiotic Depletion Potential (Fossil fuels)
ANZSIC	Australian and New Zealand Standard Industrial Classification
AP	Acidification Potential
CED	Cumulative Energy Demand
CO2	Carbon Dioxide
CRU	Components for reuse
EE	Exported Energy
EN	European Standards
EP	Eutrophication Potential
EPD	Environmental Product Declaration
FW	Fresh Water
GPI	General Program Instructions
GWPB	Global Warming Potential (Biogenic)
GWPF	Global Warming Potential (Fossil)
GWPL	Ground Water Potential Level
GWPT	Total Global Warming Potential
HWD	Hazardous Waste Disposed
ISO	International Organisation of Standardisation
KG	Kilogram
LCA	Life Cycle Assessment
MFR	Materials For Recycling
MFRE	Materials For Energy Recovery
MND	Module Not Declared
NHWD	Non-Hazardous Waste Disposed
NRSF	Non-Renewable Secondary Fuels
ODP	Ozone Depletion Potential
PCR	Product Category Rules
PENRE	Primary Energy Non-Renewable, Energy
PENRM	Primary Energy Non-Renewable, Material
PENRT	Primary Energy Non-Renewable Total
PERE	Primary Energy Renewable, Energy
PERM	Primary Energy Renewable, Material
PERT	Primary Energy Renewable, Total
POCP	Photochemical Ozone Creation Potential

RAP	Recycled Asphalt Pavement
RSF	Renewable Secondary Fuels
RSL	Reference Service Life
RWD	Radioactive Waste Disposed
SM	Secondary Material

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