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Tyre flows and recycling analysis

Project report

Final report

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GLOSSARY / ABBREVIATIONS

Bitumen crumb rubber asphalt	An asphalt product which uses crumb rubber as a binder, typically for high traffic roads.
Casings	The rigid, inner of a tyre upon which a tread is placed. Typically, tyres good enough for retread or resale as seconds are referred to as casings.
Civil engineering	Engineering discipline that deals with the built environment, including works like roads, bridges, canals, dams, and buildings.
Crumb rubber	A highly refined rubber product, typically less than 1mm in diameter, made from recycled tyres.
Domestic recycling	Activities that occur to recycle or reprocess waste tyres within Australia.
End-of-life fates	The destination of an EOLT when it reaches the end of its useful life, including recycling, energy recovery and disposal to landfill
End-of-life tyres (EOLTs)	A tyre that is deemed no longer capable of performing the function for which it was originally made.
Energy recovery	The use of EOLTs in a thermal process to recover energy for electricity generation or industrial process.
Equivalent passenger units (EPUs)	A standard measure, based on the typical weight of a standard passenger tyre, used to quantify EOLTs in Australia.
In-use	Tyres that are in demand for the purpose for which they were originally made.
Landfill / unknown	End-of-life fates for EOLTs that include licensed and unlicensed landfill, illegal dumping, burning, stockpiling or unreported exports.
Off-the-road (OTR) tyres	Tyres from mining sites, heavy industry and other unregistered off-the-road applications.
Recovery	EOLT that are collected and either reused, recycled or combusted for energy recovery either in Australia or overseas.
Recycling	Process to recovery constituent materials from end-of-life tyres and use those materials to manufacture other products.
Retreading	The preparation of used tyres for reuse by replacing the outer tread.
Reuse	The use of tyres for the purpose for which they were originally made, including use of retreaded tyres and second-hand tyres
Rubber granule	A refined rubber product, typically 2mm – 15mm, made from recycled tyres.
Rubber modified sprayed seals	A road surfacing product that uses crumb rubber as a binder, typically on high stress road areas.
Tyre derived fuel (TDF)	Shredded tyres prepared to a specification for use in energy recovery.
Tyre Stewardship Australia	The not-for-profit company established to deliver the National Tyre Product Stewardship Scheme.
Tyre derived aggregate (TDA)	Shredded tyres prepared to a specification for use as aggregate in civil engineering applications.
Tyre derived products (TDPs)	Any product produced from rubber, steel, textiles or other material recovery from the recycling of EOLTs.



1 INTRODUCTION

1.1 Project purpose and scope

The purpose and scope of this project is to inform, in relation to tyres placed on the market in Australia and subsequently recovered either locally or overseas, across the following areas:

- A simple flow diagram including source streams, sorting and processing, landfilling and other key flows.
- Brief descriptions of the lifecycle flow of tyres – imports, uses, waste streams, and local and export reprocessing. Note that there has been no local manufacture of tyres in Australia since 2010.
- Brief descriptions of the types and grades of used tyre recovered materials and where they come from.
- Descriptions of the waste infrastructure types and wastes received, including information on capacity and quantities received to the extent this is available.
- Descriptions of recycled product types and markets.

The structure of this report largely parallels each of the scope elements outlined above.

The tyres material flow analysis (MFA) modelling presented in this report is an update of the MFA modelling used in the 2017 national project led by Sustainability Victoria, *National market development strategy for used tyres 2017-2022* (REC, et. al., 2017). That report is available publicly and the MFA method and model adopted in this report are described in detail in that report.

The base year for the analysis in this report is the 2018–19 financial year.

1.2 Data limitations and assumptions

It is important to note that the data outlined in Section 3 of this report is based on a review and updated analysis of existing tyre flows data, primarily an extensive study undertaken in 2017 (REC, et. al., 2017), and the most recent Australian Border Force (Customs) data on tyre imports and exports from Australia. No direct industry consultation has been undertaken under the scope of this project to support the tyres flow quantification estimates. However, industry representatives have reviewed this report in draft, and provided feedback on the report, which has been incorporated into the report where possible.

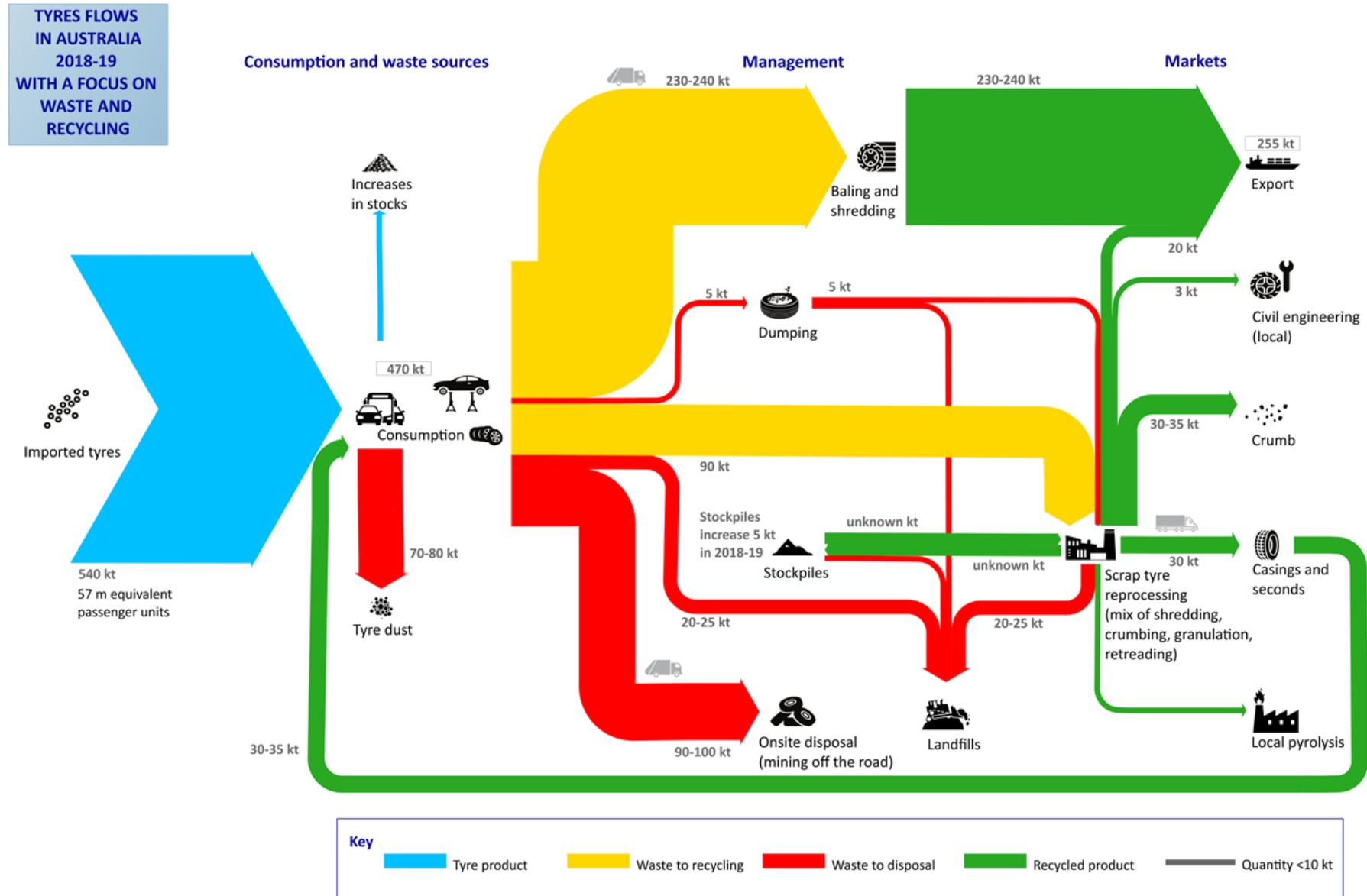
In the tables presented in this report, minor discrepancies may occur between summed totals presented in tables, and the apparent sums of the component items in tables, as summed totals are calculated using component item values prior to rounding.

Data in this report should be interpreted as having a maximum of three significant figures. However, to obtain a balance between the proper statement of the accuracy of the data, while minimising the apparent summation discrepancies previously mentioned, weight data in this report has generally been rounded to the nearest 1 000 tonnes.



2 TYRES FLOW DIAGRAM

Figure 1 – Australian tyre flows in 2018–19





3 TYRE FLOWS IN AUSTRALIA

3.1 Composition of tyres

Tyres are a composite product and are made from a combination of:

- natural and synthetic rubbers
- steel
- fibre (nylon and/or polyester)
- carbon black
- bonding agents.

The composition of tyres differs across the three main application areas of passenger, truck and off-the-road (OTR). The key compositional difference is that the rubber component of truck and OTR tyres is around 70% natural rubber and 30% synthetic on average, and passenger tyres are 35% natural rubber and 65% synthetic rubber. Natural rubber is currently preferred over synthetic rubber for the manufacturing of rubber crumb.

In addition, around 7% of passenger tyres is fabric, which does not currently have a market and when generated by tyre recyclers is disposed of to landfill. Fabric is generally not used in truck and OTR tyres.

This currently results in truck tyres being the preferred feedstock for reprocessing by local reprocessing facilities, as well as being sent to export. Passenger tyres are almost entirely sent to export, and there is little local reprocessing. There is also little OTR tyre reprocessing due to the highly variable sizes and large proportion of on-site disposal (which is not made available to recyclers).

The estimated quantities of tyres reaching end-of-life in 2018–19, by material type and tyre group, are presented in Table 1 and Figure 2.

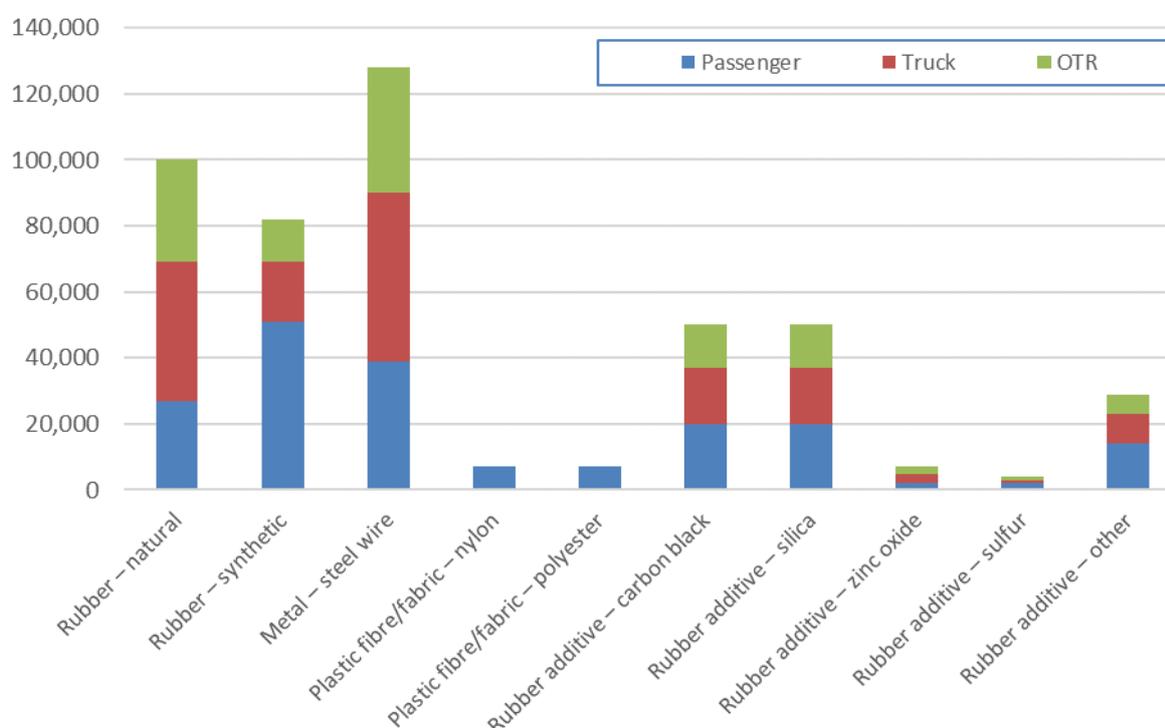


Table 1 – Australian tyres reaching end-of-life in 2018–19, by material type and tyre group (tonnes)

Material	Passenger (tonnes)	Truck (tonnes)	OTR (tonnes)	Total (tonnes)
Rubber – natural	27,000	42,000	31,000	100,000
Rubber – synthetic	51,000	18,000	13,000	82,000
Metal – steel wire	39,000	51,000	38,000	128,000
Plastic fibre/fabric – nylon	7,000	0	0	7,000
Plastic fibre/fabric – polyester	7,000	0	0	7,000
Rubber additive – carbon black	20,000	17,000	13,000	50,000
Rubber additive – silica	20,000	17,000	13,000	50,000
Rubber additive – zinc oxide	2,000	3,000	2,000	7,000
Rubber additive – sulfur	2,000	1,000	1,000	4,000
Rubber additive – other	14,000	9,000	6,000	29,000
Total	190,000	158,000	118,000	465,000

Source: REC, et. al. (2017) analysis (updated).

Figure 2 – Australian tyres reaching end-of-life in 2018–19, by material type and tyre group (tonnes)





3.2 Tyre sales

In 2018–19, the Australian new tyre market (tyre sales or consumption) was 543,000 tonnes or 57.2 million equivalent passenger units (EPUs)¹. Tyre sales by jurisdiction and tyre type are presented in Table 2 and Figure 3.

Around 43% (by weight) of tyres sold in 2018–19 were passenger tyres, 33% truck, and the remainder OTR tyres. All these tyres were imported, as passenger and truck tyres have not been manufactured in Australia since 2010, with the closure of the Bridgestone plant in Adelaide.

Table 2 – Australian tyre sales in 2018–19, by tyre type and jurisdiction

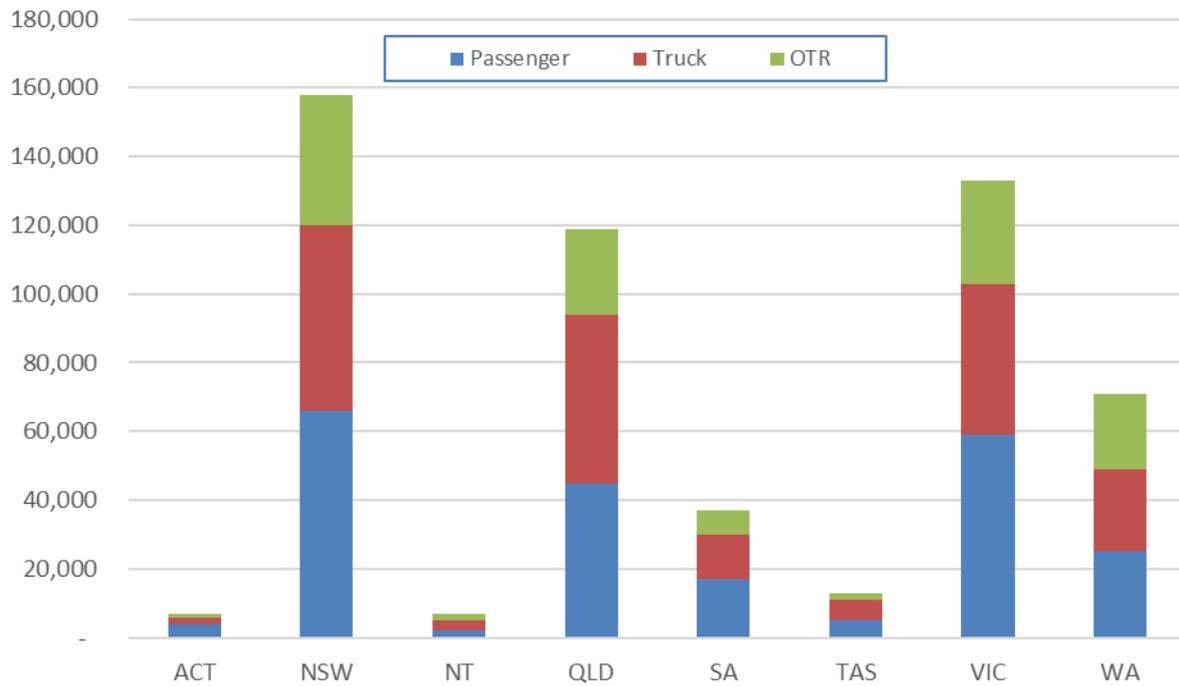
Jurisdiction	Passenger (tonnes)	Truck (tonnes)	OTR (tonnes)	Total (tonnes)
ACT	4,000	2,000	1,000	7,000
NSW	66,000	54,000	38,000	157,000
NT	2,000	3,000	2,000	6,000
QLD	45,000	49,000	25,000	120,000
SA	17,000	13,000	7,000	36,000
TAS	5,000	6,000	2,000	13,000
VIC	59,000	44,000	30,000	132,000
WA	25,000	24,000	22,000	71,000
Australia	223,000	195,000	127,000	543,000

Source: REC, et. al. (2017) analysis (updated).

¹ Adopted new passenger tyre weight of 9.5 kgs.



Figure 3 – Australian tyre sales in 2018–19, by tyre type and jurisdiction (tonnes)



Projections of tyre sales data across the period of 2013–14 to 2024–25 are also available, and are presented in Table 3 and Figure 4.

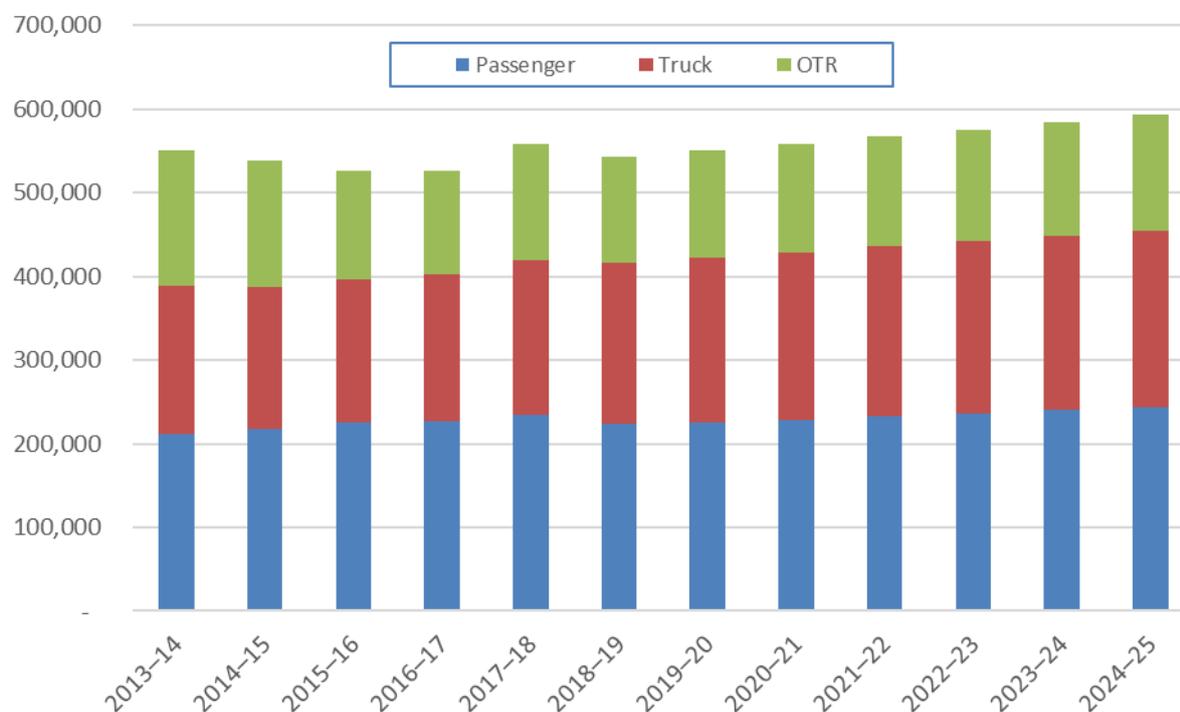


Table 3 – Australian tyre sales 2013–14 to 2024–25, by tyre group

Year	Passenger (tonnes)	Truck (tonnes)	OTR (tonnes)	Total (tonnes)
2013–14	212,000	176,000	162,000	550,000
2014–15	217,000	170,000	152,000	539,000
2015–16	225,000	172,000	129,000	526,000
2016–17	227,000	176,000	124,000	527,000
2017–18	234,000	185,000	140,000	559,000
2018–19	223,000	194,000	126,000	543,000
2019–20	226,000	197,000	128,000	551,000
2020–21	229,000	200,000	130,000	559,000
2021–22	233,000	203,000	132,000	568,000
2022–23	236,000	206,000	133,000	575,000
2023–24	240,000	209,000	135,000	584,000
2024–25	243,000	212,000	138,000	593,000

Source: REC, et. al. (2017) analysis (updated).

Figure 4 – Australian tyre sales 2013–14 to 2024–25, by tyre group (tonnes)



Per capita sales of tyres in 2018–19 are estimated at 21.3 kg/person.yr, and are forecast to remain at around this level until 2024–25.



3.3 Tyre stocks (in-use)

The useful life of a tyre is spent 'in-use', also known as 'tyre stocks'. This refers to the period in a tyre's lifecycle where it is utilised in the purpose for which it was made. Retreaded tyres and second-hand tyres are also included in the estimated tyre stocks provided in this section of the report.

Average tyre lifespans are estimated at 3.4 years for passenger tyres, 1.5 years for truck tyres, and 1 year for OTR tyres (Hyder, 2015).

In 2018–19 around 754,000 tonnes of tyres (86.2 million EPU¹) were in-use in Australia. Table 4 and Figure 5 present Australian tyre stocks in 2018–19 by jurisdiction and tyre type.

Table 4 – Australian tyre stocks in 2018–19, by tyre type and jurisdiction

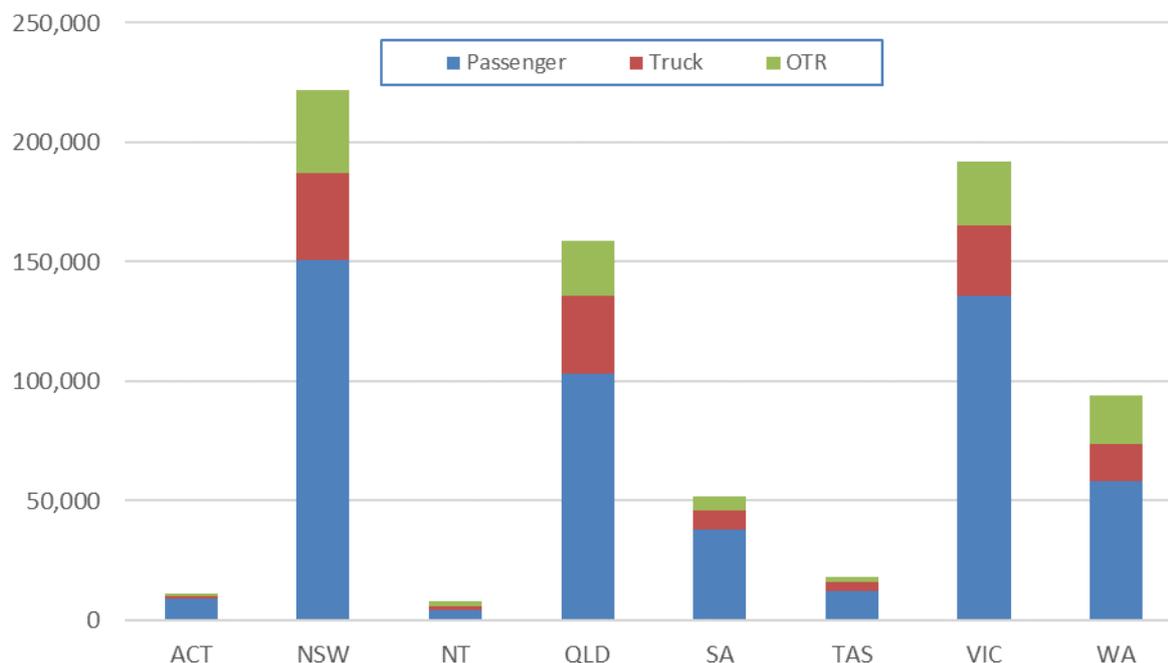
Jurisdiction	Passenger (tonnes)	Truck (tonnes)	OTR (tonnes)	Total (tonnes)
ACT	9,000	1,000	1,000	11,000
NSW	151,000	36,000	35,000	222,000
NT	4,000	2,000	2,000	8,000
QLD	103,000	33,000	23,000	159,000
SA	38,000	8,000	6,000	52,000
TAS	12,000	4,000	2,000	18,000
VIC	136,000	29,000	27,000	192,000
WA	58,000	16,000	20,000	94,000
Australia	510,000	128,000	116,000	754,000

Source: REC, et. al. (2017) analysis (updated).

¹ Assumes an average in-use passenger tyre weight of 8.75 kilograms (due to wear).



Figure 5 – Australian tyre stocks in 2018–19, by tyre type and jurisdiction (tonnes)



Projections of tyre stocks data across the period of 2013–14 to 2024–25 are also available, and are presented in Table 5 and Figure 6.

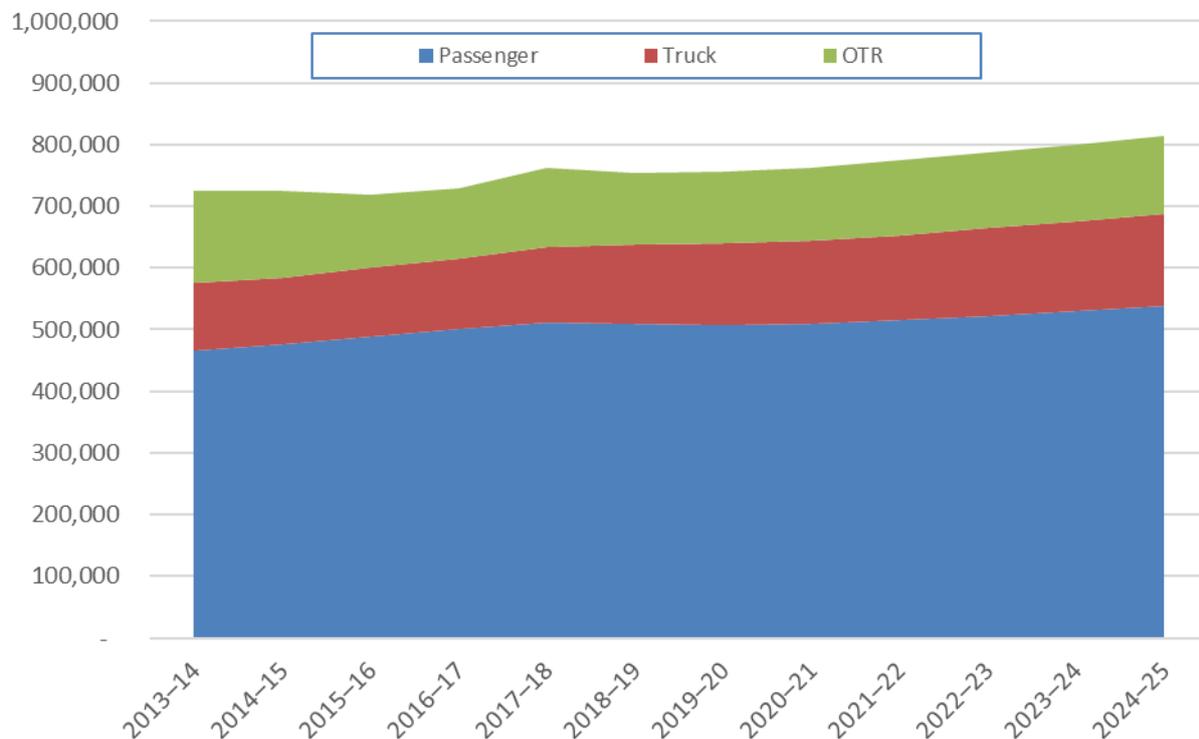
Table 5 – Australian tyre stocks 2013–14 to 2024–25, by tyre group

Year	Passenger (tonnes)	Truck (tonnes)	OTR (tonnes)	Total (tonnes)
2013–14	466,000	110,000	149,000	725,000
2014–15	476,000	109,000	140,000	725,000
2015–16	489,000	111,000	119,000	719,000
2016–17	500,000	115,000	114,000	729,000
2017–18	512,000	121,000	129,000	762,000
2018–19	510,000	128,000	116,000	754,000
2019–20	508,000	131,000	118,000	757,000
2020–21	509,000	135,000	119,000	763,000
2021–22	515,000	138,000	121,000	774,000
2022–23	522,000	142,000	123,000	787,000
2023–24	530,000	145,000	125,000	800,000
2024–25	538,000	149,000	127,000	814,000

Source: REC, et. al. (2017) analysis (updated).



Figure 6 – Australian tyre stocks 2013–14 to 2024–25, by tyre group (tonnes)



Based on projected rates of tyre consumption, Australian tyre stocks are expected to reach more than 800,000 tonnes by 2024–25.

3.4 Used tyre end-of-life arisings

The generation of end-of-life tyres (EOLTs) is determined by rates of consumption, stocks and the average lifespan of tyres. EOLT arisings in Australia were 465,000 tonnes or 58.2 million EPUs in 2018–19¹. Table 6 and Figure 7 present EOLT arisings in Australia in 2018–19.

During the use phase of tyres an estimated 15% of the tyre weight is dispersed as tyre dust to the open environment due to tyre wear. It is estimated that in 2018–19, 80,000 tonnes were lost to the environment through this pathway. Tyre wear losses are not included in the data reported in the tables and figures of this section.

¹ Assuming an EOLT EPU weight of 8 kilograms.



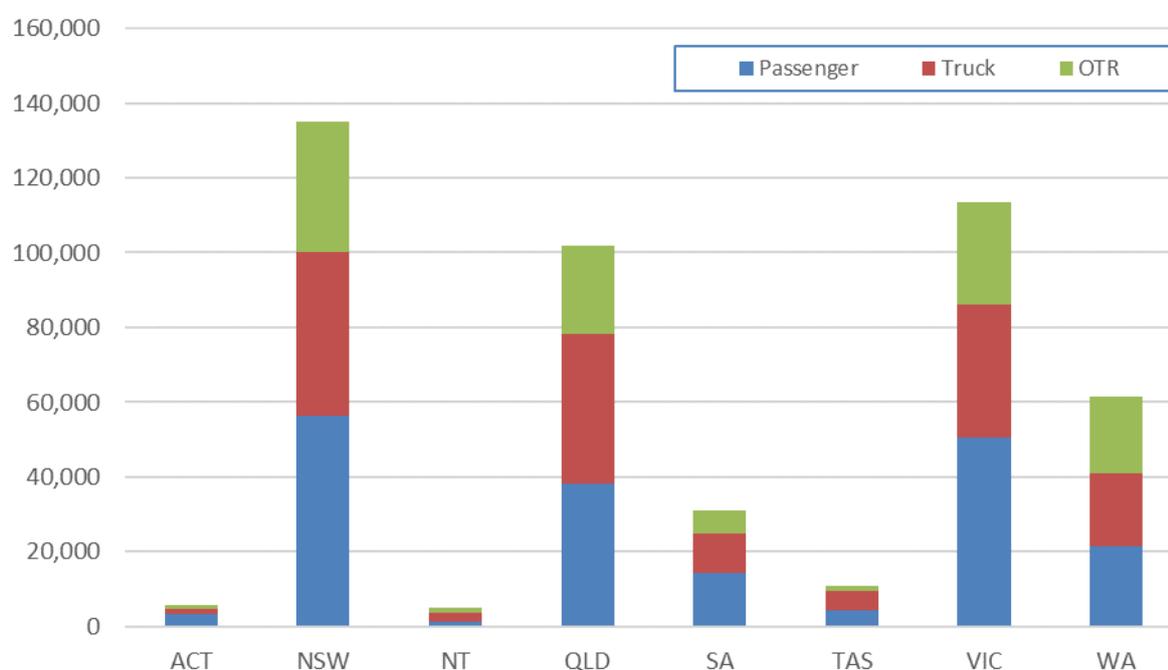
Table 6 – Australian EOLT in 2018–19, by jurisdiction and tyre group

Jurisdiction	Passenger (tonnes)	Truck (tonnes)	OTR (tonnes)	Total (tonnes)
ACT	3,000	1,000	1,000	5,000
NSW	56,000	44,000	35,000	135,000
NT	1,000	2,000	2,000	5,000
QLD	38,000	40,000	24,000	102,000
SA	14,000	10,000	6,000	30,000
TAS	4,000	5,000	2,000	11,000
VIC	51,000	35,000	28,000	114,000
WA	21,000	19,000	21,000	61,000
Australia	188,000	156,000	119,000	465,000

Source: REC, et. al. (2017) analysis (updated).

NSW was the largest generator of EOLTs in 2018–19 at around 135,000 tonnes (16.9 million EPU), with Victoria and Queensland generating around 114,000 tonnes (14.3 million EPU) and 102,000 tonnes (12.8 million EPU) respectively.

Figure 7 – Australian EOLT in 2018–19, by tyre type and jurisdiction (tonnes)





Projections of tyres reaching end-of-life across the period of 2013–14 to 2024–25 are also available, and are presented in Table 7 and Figure 8. It is estimated that around 488,000 tonnes or 61 million EPU will reach end-of-life in 2024–25, up 5% from 2018–19.

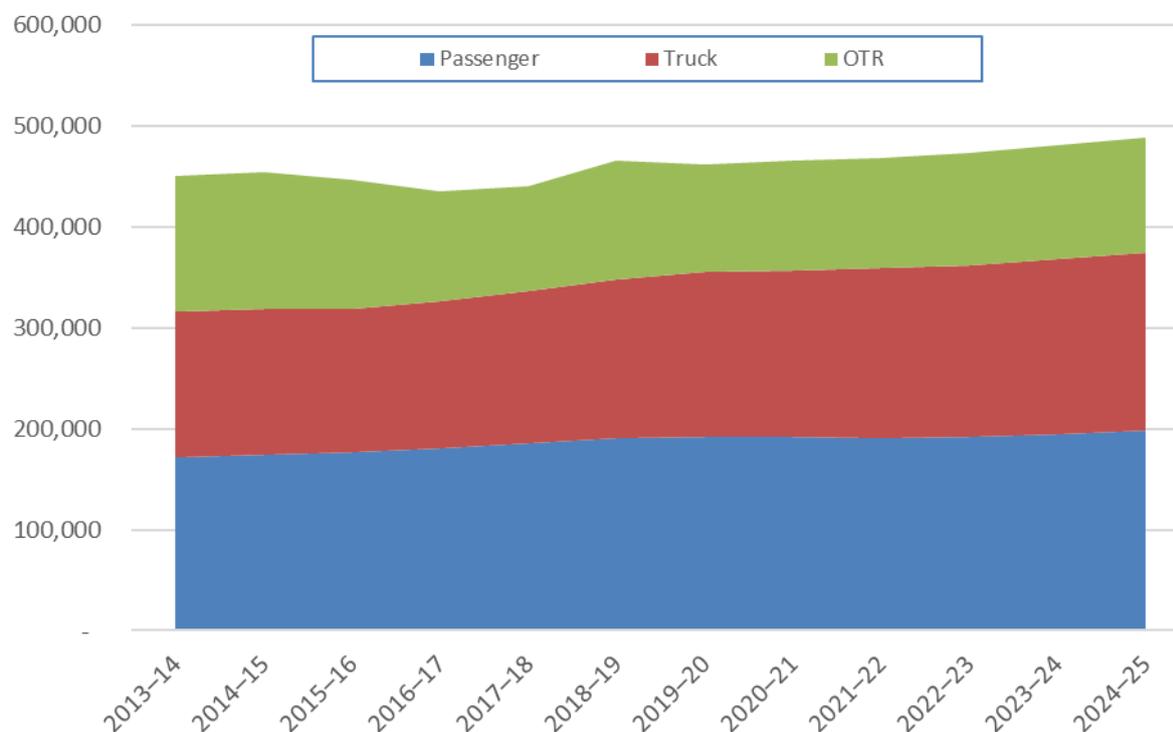
Table 7 – Australian EOLT 2013–14 to 2024–25, by tyre group

Year	Passenger (tonnes)	Truck (tonnes)	OTR (tonnes)	Total (tonnes)
2013–14	171,000	145,000	134,000	450,000
2014–15	174,000	144,000	136,000	454,000
2015–16	177,000	142,000	128,000	447,000
2016–17	181,000	145,000	109,000	435,000
2017–18	186,000	150,000	104,000	440,000
2018–19	190,000	158,000	118,000	465,000
2019–20	192,000	163,000	106,000	461,000
2020–21	192,000	165,000	108,000	465,000
2021–22	191,000	168,000	109,000	468,000
2022–23	192,000	170,000	111,000	473,000
2023–24	195,000	173,000	112,000	480,000
2024–25	198,000	176,000	114,000	488,000

Source: REC, et. al. (2017) analysis (updated).



Figure 8 – Australian EOLT 2013–14 to 2024–25, by tyre group (tonnes)



3.5 End-of-life tyre fates

It is estimated that a little over 460,000 tonnes of EOLTs were generated in Australia in 2018–19, of which around 208,000 tonnes (26.0 million EPU) or 45% were processed locally, disposed of onsite (mainly mining tyres), or sent to landfill.

A further 255,000 tonnes were exported, which is sold mostly into tyre derived fuel (TDF) related applications. Those being, either shredded tyres as fuel for cement kilns or electricity generation, or pyrolysis for fuels and steel recovery.

Note that most states and territories do not allow landfilling of whole tyres to licensed landfills, and it is not common practice to shred tyres and send them to landfill.

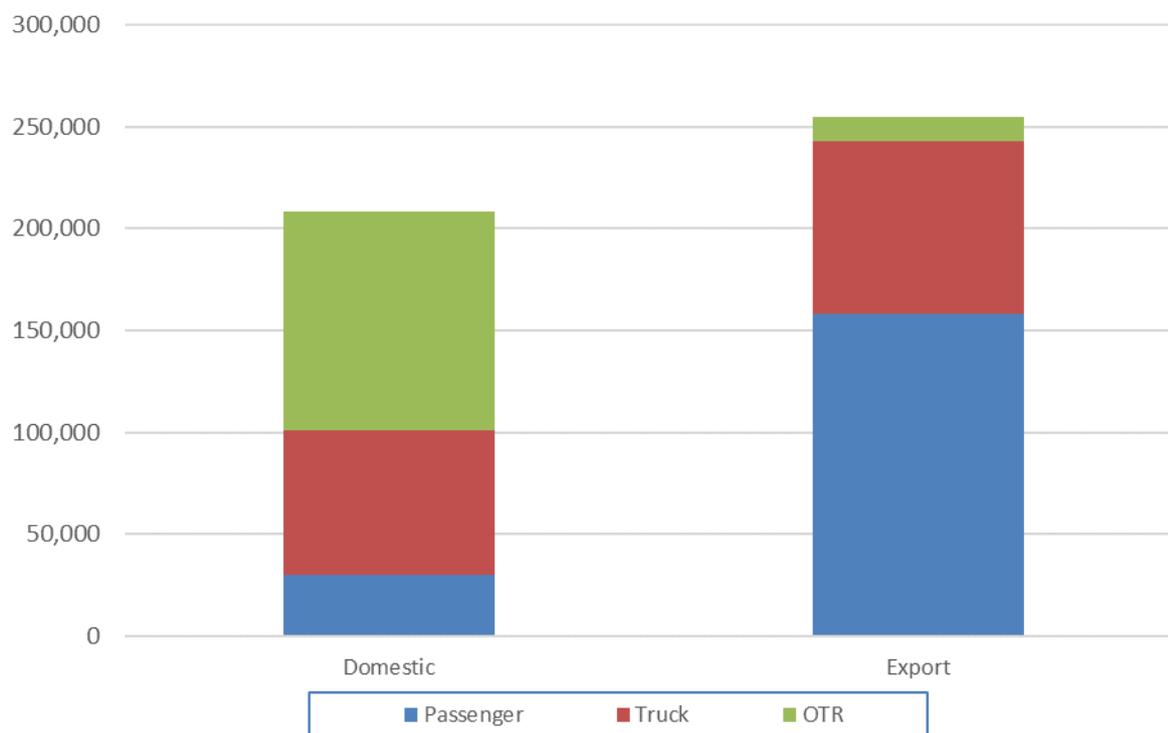
Table 8 – Indicative EoL tyre fates in 2018–19, domestic and export destinations

Destination	Passenger (tonnes)	Truck (tonnes)	OTR (tonnes)	Total (tonnes)
Domestic	30,000	71,000	107,000	208,000
Export	158,000	85,000	12,000	255,000
Total	188,000	156,000	119,000	463,000

Source: REC, et. al. (2017) analysis (updated).



Figure 9 – EoL tyre fates in 2018–19, domestic and export destinations (tonnes)



Domestic EOLT fates in Australia are summarised in Table 9 and Figure 10 below. Domestic material recycling of EOLTs in Australia remains a relatively minor contributor to overall end-of-life fates with only 65,000 tonnes (14% of all EOLT) being locally recovered in 2018–19.

Table 9 – Domestic EoL tyre fates in 2018–19

Fate	Passenger (tonnes)	Truck (tonnes)	OTR (tonnes)	Total (tonnes)
Casings & seconds	2,000	30,000	0	32,000
Civil engineering	1,000	1,000	1,000	3,000
Crumb, granules and buffings	6,000	27,000	0	33,000
Pyrolysis ¹	NR	NR	NR	NR
Stockpiles	-	-	-	5,000
Landfill	21,000	8,000	5,000	34,000
Onsite disposal (mining OTR)	0	0	96,000	96,000
Dumping	1,000	2,000	2,000	5,000
Total	32,000	70,000	107,000	208,000

Source: REC, et. al. (2017) analysis (updated).

1. Local pyrolysis processed tyre data not reported due to commercial confidentiality constraints. Quantity is currently well under 5,000 tonnes/yr.

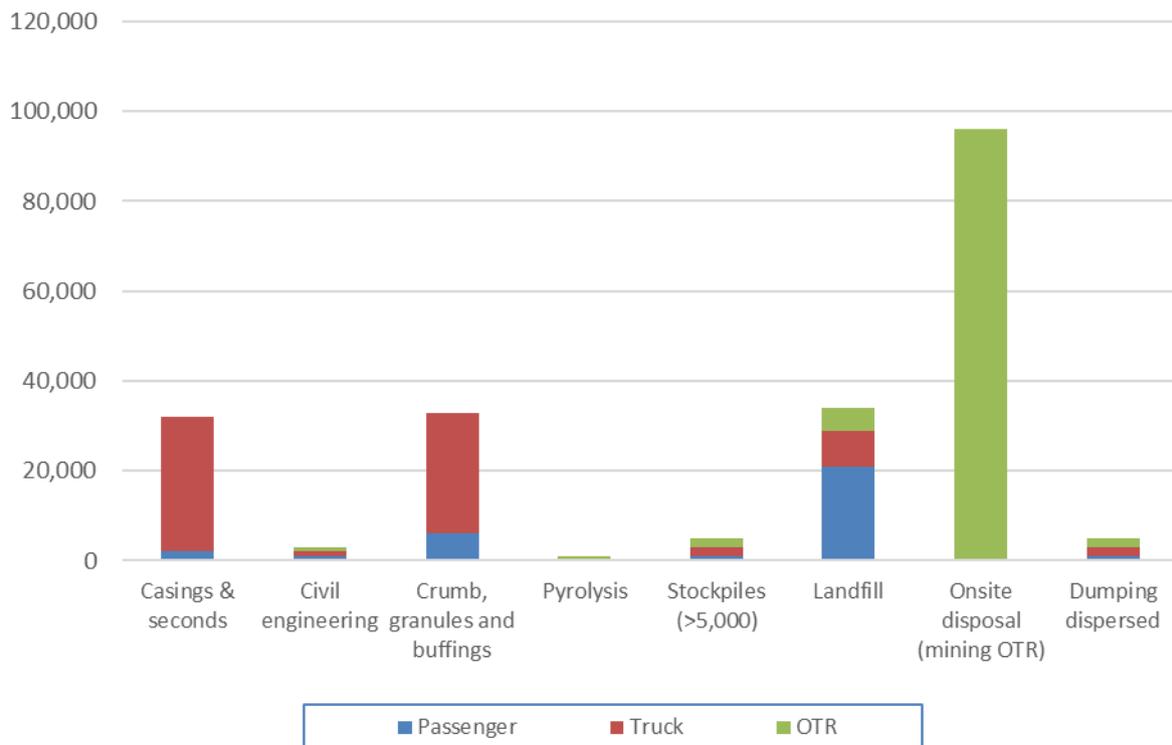


See Section 4.1 for an outline of the related applications for the fates listed in Table 9.

There was no up-to-date information available for this project on interstate transfers of tyres prior to local reprocessing. Most EOLTs are exported, and these will generally be exported directly from the jurisdiction in which they were generated.

Another important potential domestic fate for used tyres is stockpiles. There was some growth in stockpiles reported in 2018–19 of around 5,000 tonnes of tyres (TSA, 2019). The current total quantity of tyres in stockpiles nationally is unknown, but may be in the order of 100,000–300,000 tonnes. It is very important to note that these estimates are indicative only, and significant additional work is required to verify these stockpile change and total estimates.

Figure 10 – Domestic EoL tyre fates in 2018–19 (tonnes)



The major destination for EOLT is the export market for baled tyres and TDF for energy recovery. It is estimated that around 255,000 tonnes (31.9 million EPUs) or 55% of all tyres reaching end-of-life are exported. The available (indicative) data on export fates is presented in Table 10 and Figure 11 below.



Table 10 – Exported EoL tyre fates in 2018–19

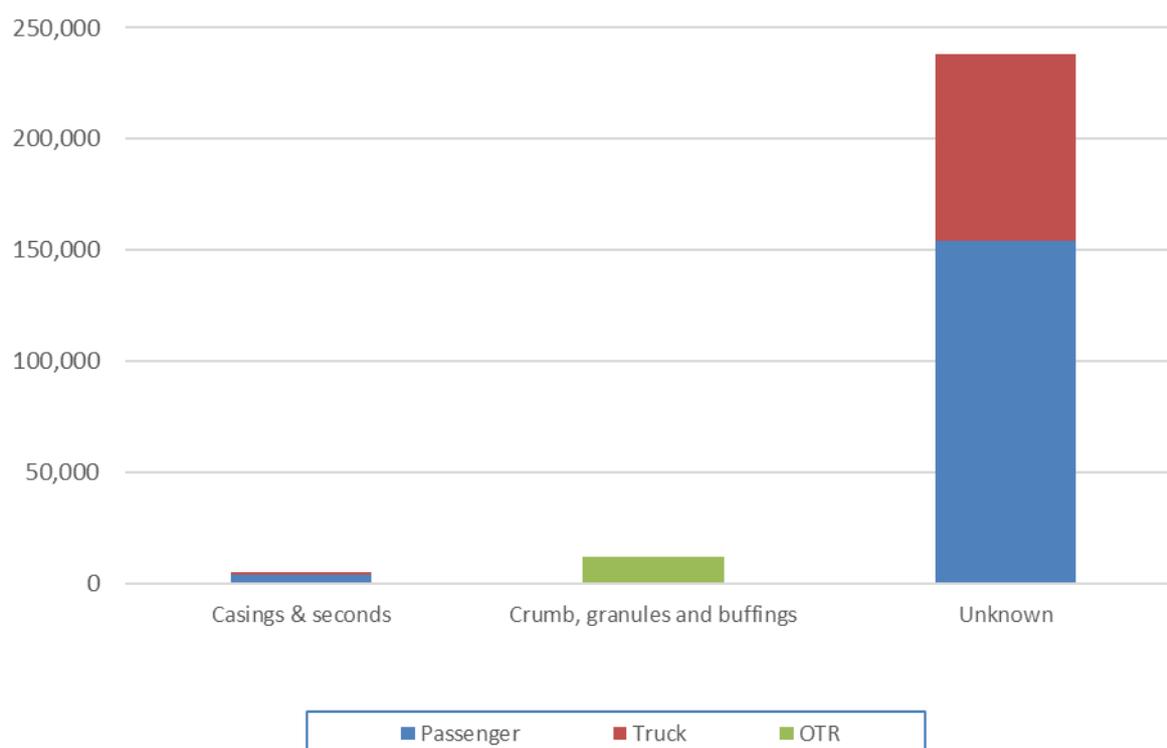
Fate	Passenger (tonnes)	Truck (tonnes)	OTR (tonnes)	Total (tonnes)
TDF and unknown ¹	150,000	80,000	-	~235,000
Casings & seconds	-	-	-	~20,000
Crumb, granules and buffings	-	-	-	
Total	158,000	85,000	12,000	255,000

Source: REC, et. al. (2017) analysis (updated).

1. Assumed mostly into TDF related applications.

No export of retreaded tyres from Australia has been identified, however some may occur. It is anticipated that generally (unretreaded) casings will be exported for retreading overseas.

Figure 11 – Exported EoL tyre fates in 2018–19 (tonnes)



In 2018–19 the major receiving countries for exported EOLTs is summarised in Table 11 below. India was the major receiving country, importing around 39% of Australian EOLTs where the destination country was identifiable. These tyres are likely to be either burnt or pyrolyzed for fuel and steel recovery. Malaysia and South Korea received 28% and 19% of EOLTs respectively, where the destination country was identifiable.



There is a significant mismatch between the used tyre exports that are readily identifiable in the Customs export dataset, and exports as reported by local collectors and processors in 2018–19 (TSA, 2019). Around twice as many tyres are reported as exported by industry (through direct survey) as are identifiable in the Customs data. For this reason, the destination countries of around 50% of exported tyres are unknown. This means that the exports to the countries listed in Table 11 are probably significantly understated, so should be regarded as minimums.

Table 11 – Exported EoL tyre fates in 2018–19

Destination	Passenger (tonnes)	Truck (tonnes)	OTR (tonnes)	Total (tonnes)	Reported typical major applications
India	31,000	14,000	4,000	48,000	Whole tyres into pyrolysis facilities and various industrial furnace and kilns.
Malaysia	22,000	10,000	3,000	35,000	Whole and shredded tyres into pyrolysis facilities and various industrial furnace and kilns.
Republic of Korea (South)	21,000	2,000	-	23,000	Shredded tyres into electricity generation and cement kilns.
United States	4,000	-	-	4,000	Possibly dominated by retreads and casings.
Singapore	2,000	-	-	2,000	Unknown.
Liberia ¹	1,000	-	-	2,000	Whole tyres into pyrolysis facilities and various industrial furnace and kilns.
China	1,000	-	-	1,000	Unknown.
Japan	1,000	-	-	1,000	Shredded tyres into electricity generation and cement kilns.
Other known countries	7,000	1,000	-	8,000	Various.
Other unknown countries ²	68,000	58,000	5,000	131,000	Assumed commonly whole tyres into pyrolysis facilities and various industrial furnace and kilns.
Total	158,000	85,000	12,000	255,000	

Source: REC, et. al. (2017) analysis (updated).

1. Identifiable aggregated exports to African countries as a group were at least 4,000 tonnes in 2018–19.

2. These 'unknown country' destinations are anticipated to primarily be India and South Korea.

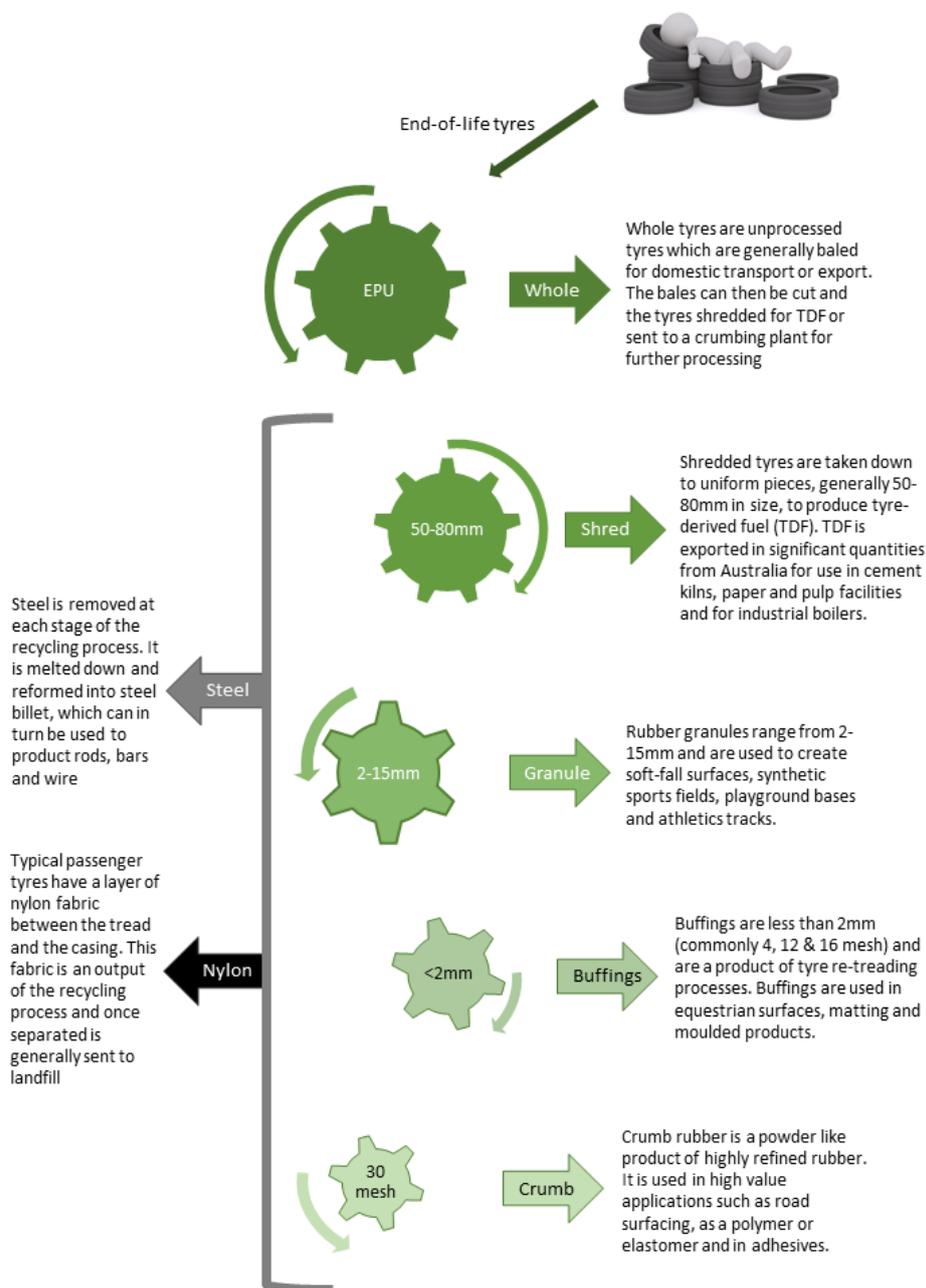


4 USED TYRE RECYCLING

4.1 Mechanical recycling of tyres

Australia tyre recycling is dominated by mechanical recycling methods which use a series of shredders, screens and granulators to separate materials, and manufacture a range of tyre derived products (TDPs). An overview of the related TDPs and applications are outlined below.

Figure 12 – Overview of mechanical recycling TDPs and applications



Source: REC, et. al. (2017, p. 9).



4.1.1 Whole tyres / casings

Whole recovered tyres (commonly referred to as “casings”) are unprocessed tyres which can be sold locally or exported for second-hand reuse or retreading.

The domestic market for casings has declined significantly over the last decade with Australian consumers moving away from passenger tyre retreads. However, truck and light truck casings are still recovered for retreading with facilities operating in most capital cities. There is a strong casings export market from Australia into Asia and Africa.

4.1.2 Baled tyres

Whole tyres are compressed using a hydraulic bale press and then bound with high tensile wire to form a block shape. Baling is a fast and relatively cheap process that can greatly improve efficiencies for both interstate and international transport. However, tyres are rarely baled for transport to local recyclers.

It is reported that tyres are particularly sought after in India, as the bales can be handled manually, unlike containerised shredded tyres.

Bales typically contain more than 100 EPUs and range from 500 kg up to two tonnes in weight.

It is worth noting that the cost of baling tyres has been estimated at around \$70 per tonne, compared with shredding costs of around \$80–\$120 per tonne (REC, et. al., 2017). The off-shoring cost for baled or shredded tyres is around \$30–\$40 /tonne. These are 2017 estimates.

4.1.3 Shredded tyres

Most EOLTs in Australia that are recovered for recycling end up in the form of shredded (chipped) tyres with the dominant product in this market being tyre-derived fuel (TDF). Exports of EOLTs for energy recovery (which includes TDF and baled tyres) accounts for approximately 80% of the local and export used tyre market.

4.1.4 Granulate / buffing

Rubber granulate is generally in the order of 2mm – 15mm and is produced via a series of granulators and screens that further process shredded tyres into a refined, uniform product. Granulate is mostly free from contaminants with the metal and fabric removed via magnets and air separation respectively.

Buffings are pure tyre rubber that are effectively shaved off the remaining tread on a tyre casing during the retreading process. Casings are mounted on a rotating disk and a series of blades strip the tread to the point that the casing is ready for the new tread to be applied. Buffings are around 10–20mm in length and are highly valued due to the very low contamination levels.

Granule and buffings are used in soft-fall surfacing, moulded product, playgrounds and equestrian surfaces (REC, et. al., 2017).



4.1.5 Crumb rubber

The most highly refined product from traditional tyre recycling is crumb rubber (also known as rubber crumb, crumb or powder). Crumb rubber is less than 1 mm in particle size diameter and is produced using a three-stage grinding process to separate rubber, fabric and steel. Less commonly, crumb rubber can be produced using a cryogenic process where the rubber is frozen with liquid nitrogen and ground in a hammer mill. Cryogenic crumbing is no longer undertaken in Australia due to the processing cost.

Crumb rubber makes up a significant part of the domestic market for TDP with applications ranging from asphalt pavements to high value polymer products and explosives. However, infrastructure costs are high with a commercial scale crumbing plant likely to cost in excess of \$10 million (REC, et. al., 2017).

4.1.6 Steel

Tyres often contain two steel products. A thin layer of high tensile steel known as “steel belt”, sits beneath the tread to provide reinforcement for the rubber and give the tyre strength in supporting heavy loads. In addition, the sidewall of a tyre contains steel beading or wire which keeps the tyre locked safely onto the bead of the wheel rim.

Recovered steel is processed by metal recyclers back into commercial grade steel billet. The scrap steel recovered from tyres is a low value form of steel scrap.

Passenger tyres are around 16% steel by weight, and truck/OTR tyres are typically 25% steel by weight (REC, et. al., 2017).

4.1.7 Nylon and polyester fabric

Passenger tyres commonly have a layer of nylon fabric beneath the tyre tread and the steel belt as further reinforcement. This is typically either nylon or polyester and can be extracted during the recycling process using air separation. The resultant material is typically sent to landfill in Australia.

4.2 Chemical recycling of tyres

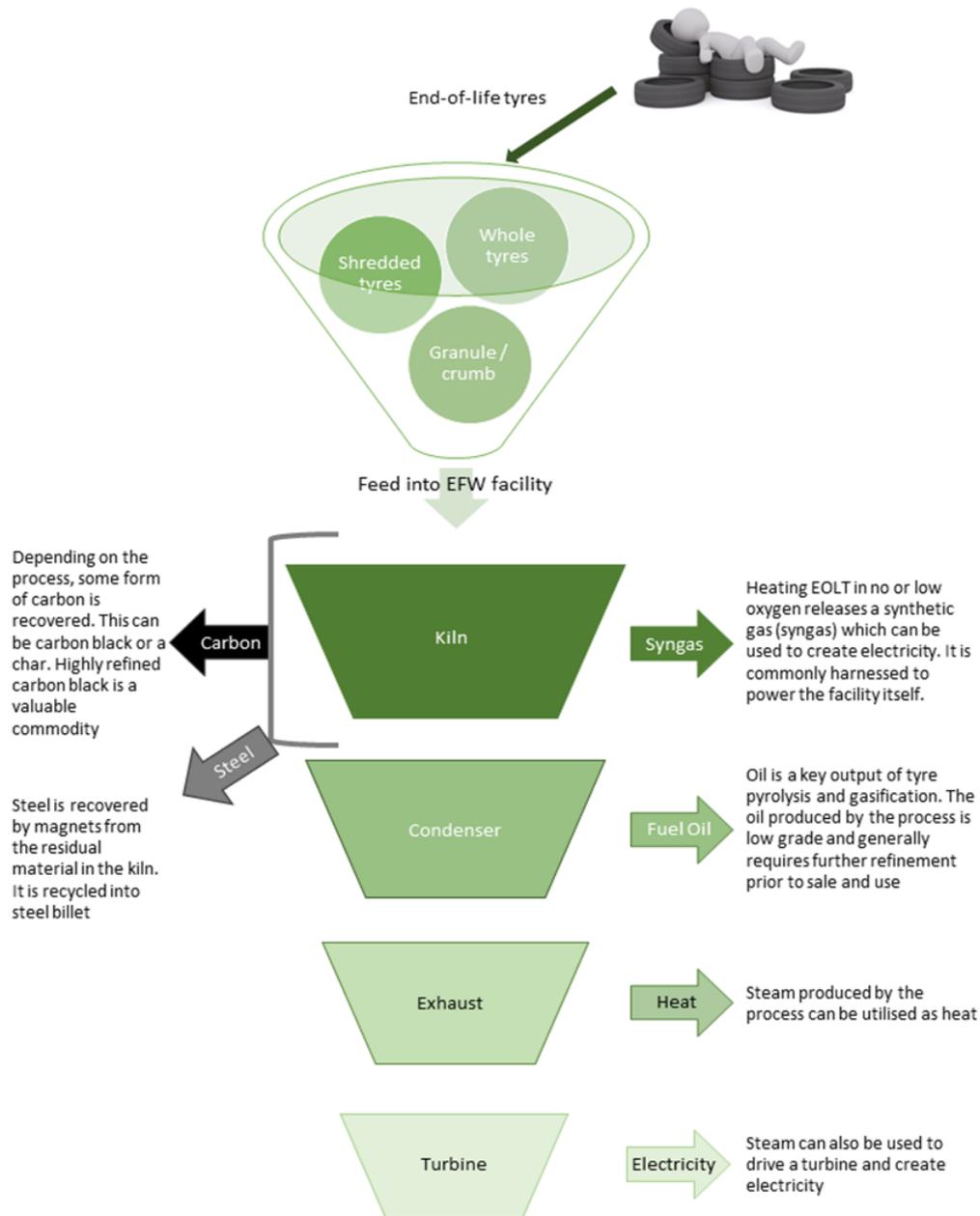
There is ongoing development of chemical recycling technologies designed to use EOLTs as a feedstock. These are typically based on pyrolysis and gasification processes. See Figure 13 overview of TDPs from this type of used tyre processing technologies.

There are a number of facilities in the early commercialisation phase in Australia. These include (but are not limited to):

- Green Distillation Technologies (Warren NSW)
- Pearl Global (Willetton WA)



Figure 13 – Overview of chemical recycling TDPs and applications



Source: REC, et. al. (2017, p. 12).

4.3 Tyre recyclers in Australia

Summarised in Table 12 are the larger EOLT recyclers currently operating in Australia that have been identified, along with a short description of their main tyre related recycling activities. In total, seven companies undertaking crumbing have been identified, two specialising in baling, two specialising in using whole tyres in civil works, three in casings/retreads, and three pyrolysis facilities.



This list is presented here to provide an understanding of the approximate number and spread of business activities in the used tyre management sector.

It is important to note that the list is not comprehensive, and in particular there are likely to be a number of companies specialising in baling and exporting of tyres that are not listed.

Table 12 – EOLT recyclers in Australia

Company	State/Territory	Main activities
Australian Tyre Processors	QLD	Shredding.
Bandag	QLD	Retreading.
BG & JM Barwick	TAS	Shredding.
BSV Tyre Recycling Australia	NSW	Baling, shredding and crumbing.
Chip Tyre	QLD	Shredding and crumbing.
D&N Rubber Refinery	NSW	Shredding and crumbing.
Ecoflex International	NSW	Whole tyres into civil works.
Elan	WA	Pyrolysis facility and baling.
Green Distillation Technologies	NSW	Pyrolysis facility.
JLW Services	NSW	Shredding and crumbing.
Lomwest Enterprises	WA	Whole tyres into civil works.
Oz Tyre Recyclers	VIC	Baling.
Ozcom Recycling	QLD	Casings.
Pearl Global	WA	Pyrolysis facility.
Ray Johnson Scrap Tyre Disposals	NSW	Casings.
Seven Star Rubber Crumb	QLD	Shredding and crumbing.
Tyre Crumb	VIC	Shredding and crumbing.
Tyre End	QLD	Casings.
Tyrecycle (ResourceCo)	National	Shredding and crumbing. Recycling facilities in all states.

Source: Envisage Works and REC, et. al. (2017).



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