



# Product Group Report: Tyres

A study of tyre remanufacturing in the UK  
(First conducted on behalf of MTP)

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# Glossary

CO <sub>2e</sub>	The net emissions of the life-cycle expressed as the equivalent amount of carbon dioxide.
LCA	A technique whereby the various effects of manufacturing, using and disposing of an item or service are evaluated according to a methodology for a stated set of parameters.
OEM	Original Equipment Manufacturer; the first manufacturer of a new item, holding design specifications and possibly copyright.
RMA	Retread Manufacturers Association; trade body for the sector.
WRAP	Waste & Resources Action Programme; Defra-funded body charged with promotion of recycling and recycling businesses in the UK.

# Acknowledgements

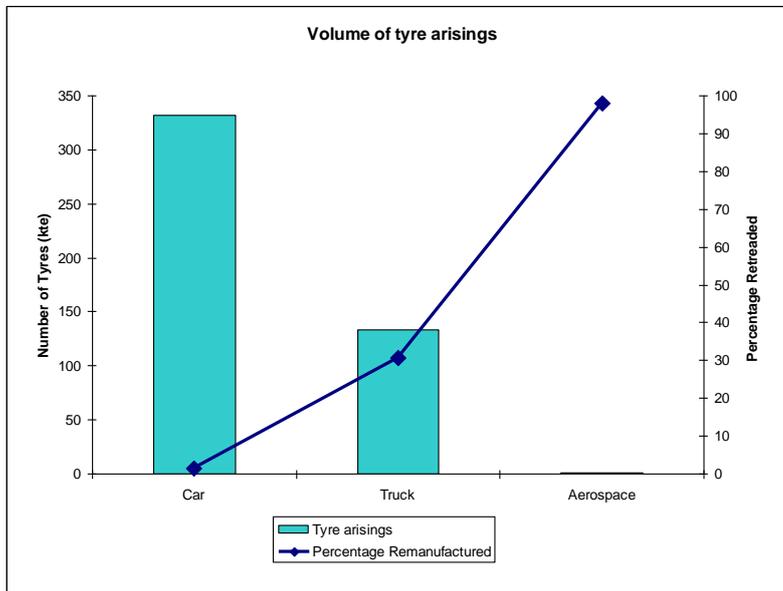
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# 1 Overview

Used tyres arise from three sources: cars, trucks and aircraft. The vast majority of arisings by number is car tyre. However, by weight, approximately one-third of all arisings are from trucks, with only a small fraction from the aerospace industry. In contrast, the fraction of re-treading in these categories is reversed: Due to their cost and complete traceability, virtually all aerospace tyres are remanufactured at least once, whereas the percentage of car tyres remanufactured is very low.

Figure 1: UK tyre arisings and remanufacture percentage, by industry sector.<sup>1</sup>



Since the aerospace industry is a low volume, saturated market, this report mainly describes the current state of the truck and car tyre remanufacturing industry. However, several lessons can be drawn from the aerospace industry. It shows that re-treading produces high quality, high performance tyres and that there is little technical reason why these practices could not be implemented throughout the road vehicle sector: an industry where unsafe equipment, or even the possibility of unsafe equipment, cannot be tolerated. The cost impetus is only a partial explanation for the widespread use of re-treaded tyres in the aerospace industry. Other reasons are:



- There is direct traceability of the tyre casings throughout their life.
- There is planned and routine maintenance of tyres.
- The high quality control procedures of the aerospace re-treading industry.

By comparison, if the reputation and practices of the aerospace industry could be overlaid onto the road vehicle re-treading industry then the stigma attached to re-treaded tyre might be removed.

There are two different remanufacturing processes that can occur on used tyres:

- **Re-grooving.** This is the process of cutting a new tread into a bald tyre (where sufficient base rubber remains to do so safely). This is common practice for truck tyres, with estimates as high as 60% of all tyres going for re-grooving before re-treading. The practice, however, is illegal for car tyres.
- **Re-treading** (and the alternative, re-moulding). Re-treads and re-moulds involve applying new rubber to the tyre to extend its life. Re-treading involves gluing a pre-vulcanised rubber tread onto a bald tyre casing, whereas re-moulding involves injection moulding rubber onto a tyre casing to form a new tread, then vulcanising the rubber tread in situ. Within the industry, re-moulding is considered to produce a higher quality product. Both terms are regularly interchanged, but industry statistics are not available to differentiate between the two processes. Therefore the term re-tread will be used to encompass both re-treading and re-moulding.

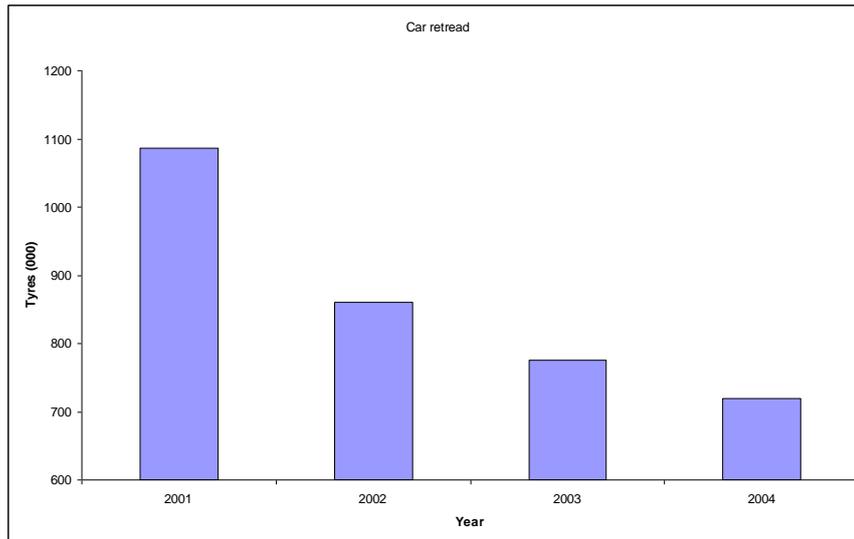
Every year, 2% or 5,400 tonnes of car tyres are re-treaded. There are several contributory factors for this small percentage:

- The public perceive that re-treads are poor quality.
- The cost-conscious budget tyre market is extremely competitive compared to the cost of remanufactured tyres.
- In some regions, there is a poor availability re-tread distributors.
- Tyre distributors have a tendency to favour certain OEM makes or they will not offer re-treaded tyres as an option to the consumer.
- Vehicle manufacturers fit only favoured OEM product to new cars.



The car re-tread market has seen a steady decline in recent years. Although, over time, road safety standards have forced this industry to improve its quality such that the re-treaded car tyres are generally considered as safe as new, it has never shaken off the original re-treading industry's reputation for producing poor quality products. New EU regulations (ECE 108 and 109) on the production of tyre re-treads should further reduce concerns over safely using re-treaded tyres.

Figure 2: Decline in the British car re-treading industry from 2001.



Approximately 920,000 truck tyres, 33% of the total, are remanufactured in the UK each year. The higher inherent value of truck tyres (and therefore the used casings) incentivises remanufacturing. Large fleet operators, being more value-conscious than other purchasers, have traditionally under-pinned this sector. Fleet managers are better informed, safety issues better understood, as a consequence of which, re-treads are generally not used on the drive axles of trucks.

## 2 Value

Over the past five years, the price of truck tyres has halved, which has impacted on the re-tread industry. The general consensus is that this represents serious under-pricing. There have been moves throughout the industry to try to increase the price of tyres but, because market prices are controlled by tyre distributors, who are reluctant to increase prices of new tyres, success has been mixed. However, the industry does expect the price of truck tyres to rise over the next



few years, mainly because the industry's margins are very low and the price of oil and energy continue to rise.

Car tyre re-treading is now limited largely to the higher value 4x4 and high performance tyres. At present, the low value imports of new tyres from China are reducing the potential market for the re-tread industry. In fact, the price differences are so small in the budget tyre sector – the original core business of the re-tread industry – that justification for buying re-treads on price alone is slim. However, increasing oil prices may raise new tyre prices to the point where re-treads become a more attractive alternative.

## 3 Evolution rate

Although truck tyres can be re-treaded several times, and therefore be in service for several years, the evolution of the truck tyre market is not sufficient to make tyre casings obsolete before the end of its serviceable life.

Average car tyre size is increasing in line with changes to the British car. Therefore older tyres are in less demand. 'Run-on-flat' tyres are a recent development and a potential opportunity for the re-tread industry. These tyres, currently aimed at the luxury car market, are extremely expensive, retailing for around £250 each. The residual value of used tyre casings should allow the re-treading industry to make healthy margins whilst still offering significant savings to the consumer, and remanufacturers are preparing to service this sector.

## 4 Reconstructability

Re-treading is a well understood technique, which can be implemented on a large scale on a wide range of tyres.

Access to high quality tyre casings is becoming an issue. The Re-tread Manufacturers Association (RMA) would like to see all car tyre cases re-treaded once, equating to potential arisings of 40 million tyres per year. However, the general treatment of tyres during their life has a significant impact of the number of tyre casings eligible for re-treading. Tracking and camber misalignment, under- and over-inflation, scuffs and damage caused by poor driving or using the tyre past its tread limit all reduce the number of viable cores available for re-treading. In addition to this, the construction of some tyre casings make them unsuitable for re-treading. Accordingly, the re-tread industry estimates that only 20% of all tyres removed from cars are suitable for re-treading. Even so, this



equates to over ten times the number of tyres which are being re-treaded currently.

With growth in run-on-flat tyres, this valuable segment should not be excluded from remanufacture: There is a need for research into re-treading these tyres with due regard to safety implications. These innovations are likely to increase the market share of this segment.

## 5 Potential

The potential materials and CO<sub>2E</sub> saving from re-treaded car tyres is very large, dwarfing all other product groups discussed in this document. If we assume that the theoretical maximum number of tyres which can be re-treaded is 20%, this equates to approximately 58,000 tonnes of tyres or 270 kt CO<sub>2E</sub> saved per year (see below for assumptions). Due to the high volume of the industry, even modest changes in the number of re-treads produced will result in large CO<sub>2E</sub> savings.

## 6 Access to casings

### 6.1 Tyre arisings

The number of tyres arising may increase slightly over the next few years as car reclaimers diligently remove whole tyres from vehicles in an effort to meet the requirements of the tightening of the end of life vehicle (ELV) Directive. To hit the statutory recycling rates, reclaimers will certainly remove tyres which would have otherwise been shredded and landfilled.

An important element to this industry is good quality used tyre casings. Current end of life situation for the tyres is: Out of a total of 480,000 tonnes of used tyres, 240,000 tonnes are diverted from landfill into other recycling and reclamation uses<sup>a</sup>. A significant mass, 23,000 tonnes, of tyres is unaccounted for. These arise either from crushing of end of life vehicles ending up in the MSW stream, or are burned.

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<sup>a</sup> This excludes re-tread, reuse and re-groove, which itself consumes 80,200 tonnes of used tyres per year.



## 6.2 Recycling

There are over a dozen significant applications for used tyres. Both reclaimed rubber and steel can displace raw materials. There is also a large demand for tyres as fuel and as a reducing agent in cement kilns. End use is determined by the tyre construction:

- Car tyres contain a large amount of cord, which makes them harder to process compared to truck tyres and less desirable as feedstocks for crumbing. A larger portion of car tyres are burned in cement kilns.
- Truck tyres favour material recovery operations, since with a higher steel content and a higher proportion of natural rubber in the compound, they can attract premium prices.

The used tyre market is likely to continue to tighten: cement manufacturers have been signalling that they will increase their usage of tyres in their kilns for several years. However, due to a series of technical barriers, this has not yet occurred. Other recycling projects are also increasing demand on raw materials which is likely to increase pressure on the supply chain.

# 7 Recommendations

The sector is unique within this report: Within three to five years there will be a use for virtually all used tyres. Therefore, a decision on intervention in the re-tread industry will be based on any additional environmental benefit which re-treading used tyre casings has over other recycling applications.

## 7.1 Resource efficiency

The three of the most common uses of used tyres (by weight) are:

- Energy recovery through cement kilns (usually replacing coal).
- Landfill engineering (replacing aggregates).
- Equestrian ménages and pathways (replacing woodchip).



Data from Enviros on the CO<sub>2E</sub> of manufacture is summarised in the table below.

Table 1: CO<sub>2E</sub> emissions per tonne of product made.<sup>2</sup>

Material	CO <sub>2E</sub> of manufacture (kg per tonne)	Net CO <sub>2E</sub> change per tonne
Tyres	755	-755 <sup>a</sup>
Re-treaded tyres	104	-104
Aggregates	61	-694 <sup>b</sup>
Wood	7	-748 <sup>b</sup>
Plastic	2,877	+2,122 <sup>c</sup>

<sup>a</sup> Assumes the disposal of the tyre to landfill.  
<sup>b</sup> These figures assume that the energy to reprocess is zero, due to the rudimentary mechanical treatment to turn tyres into the product, this should be largely correct.  
<sup>c</sup> Net energy gain assumes a 'perfect' process involving no added embodied energy. Real world processes would significantly reduce the efficiency of turning rubber into usable plastics.

It is clear from the table that re-treading tyres is approximately 7.5 times more energy-efficient than landfilling and producing a virgin tyre. If a used tyre casing is recycled into either aggregate or wood substitute, this will save approximately 61 and 7 tonnes respectively of CO<sub>2E</sub> per tonne of material. However, there is also an added energy expense of producing a new tyre (775 kg of CO<sub>2E</sub>), which results in aggregate and wood substitution being respectively ca. 7 and 7.5 times less efficient than re-treading the used tyre casing. This assumes that the cost of processing tyres is low. If this is not true then, from a CO<sub>2E</sub> perspective, it is more environmentally prudent to landfill the tyres and use virgin materials. The small quantities of emissions required to make aggregate and wood substitutes suggest that the greatest emission of CO<sub>2E</sub> is likely to be from the transport of the material to its point of use.

Conversion into plastics is a more promising use of used tyres casings. If the process is energy efficient then a net saving of up to 2.1 tonnes of CO<sub>2E</sub> per tonne of plastic can be realised. However, this assumes that the tyres replace the plastics on a tonne-for-tonne basis, whereas in reality this maybe difficult to achieve.

The other main use of used tyre – cement energy recovery – results in shredded, and in some cases whole, tyres replacing the cement kiln's main fuel: coal. Below is a table of the relative energy and CO<sub>2</sub> emissions for burning coal and tyres.

Table 2: Comparison of calorific and CO<sub>2</sub> emissions of coal and tyres.

Material	Energy (GJ/tonne)	CO <sub>2E</sub> (kg) per tonne incinerated	CO <sub>2</sub> (kg) per GJ
Coal	25	588	24
Tyres	28	757	27



The higher calorific value of used tyres means that one tonne of used tyres replaces 1.1 tonnes of coal. However, incinerating tyres produces an extra 3 kg of CO<sub>2E</sub> per GJ of energy generated, and therefore produces a worse environmental impact than incinerating coal. Added to this is the lost CO<sub>2E</sub> from manufacturing a new tyre, 755 kg of CO<sub>2E</sub> per tonne of tyres, which would have otherwise been displaced by the re-treading of the incinerated tyre. Therefore, using tyres to replace coal as a fuel in cement kilns results in a net increase in CO<sub>2E</sub> emissions of approximately 854 kg per tonne of tyres compared to re-treading.

These calculations are only correct for tyres which could have been re-treaded, and not tyres unsuitable for the process. They suggest that, in energy terms, there is little net gain or loss of CO<sub>2E</sub> in using recycled tyres as aggregate or wood substitutes or incineration in cement kilns, but the real losses occur in replacing the used tyre casing, which could have been re-treaded, with a virgin tyre.

This throws into doubt the environmental benefit of using used tyres that could have been re-treaded in other recycling schemes: although they are a great success in reducing the amount of waste entering landfill, the actual environmental benefit of these schemes over re-treading (in terms of CO<sub>2E</sub>) is marginal. It follows that policy changes should encourage all viable casings towards re-treading, even at the expense of other recycling initiatives.

There is probably very little room for growth in the truck tyre re-treading industry. Cost-conscious fleet operators already see re-treading as a viable way of controlling costs and will actively pursue a re-treading policy. Therefore, we feel that the largest gains in this area can be made in the car market. To encourage the use of re-treaded car tyres, the Re-tread Manufacturer's Association (RMA) has identified three target groups:

- **Environmentally conscious customers**

There is a significant number of people who are willing to buy based on environmental issues, for whom the overall cost of the product is not the priority. Promoting the environmental benefits of re-treaded tyres to this segment may encourage them to choose re-treads over virgin. It is likely that the issues of safety surrounding this industry will be the major obstacle in encouraging the sector to use re-treads.

There have been several different concepts proposed to encourage the sale of re-treaded tyres: advertise at point of sale, either as flyers or posters; use the distributors to promote the benefits of re-treaded tyres; local press advertising; national advertising in relevant, environmental literature and promotion at ethical product exhibitions.

To ensure that re-treads are readily available, the RMA is performing a survey to identify dealers who stock passenger re-treads. The RMA is hoping to plug gaps in the distribution network by approaching relevant dealers. Incentives to dealers to stock and promote re-treaded tyres may encourage a larger distribution network.



- **Local Authority fleets**

As with several sectors within this report, governmental policy on the use of environmentally beneficial products will have a large impact on the number of re-treads sold. There is possibility to address this through the QuickWin scheme (see Printer section).

- **Company fleets**

This requires careful identification of the relevant companies, and is likely to have greatest success with companies in the environmental/ethical products sector.

Beyond market, other levers may be employed to boost re-tread sales:

- **Tax incentives for using re-treaded tyres**

Possibly a cut in road tax. This could be monitored through MOT checks.

- **Information to passenger car users on tyre care**

This is currently being performed from a safety viewpoint but could also include is some small element to encourage using re-treads. Approximately 13% of all tyres on Britain's roads have less tread than the legal limit, which is obviously dangerous and reduces the likelihood of the tyre being of sufficient quality for remanufacture.

## 7.2 Resource efficiency impacts

### ***General Assumptions:***

Due to the stability and high level of remanufacture, it is assumed that truck tyre re-treading is at a saturation level. Therefore these models focus on affecting the car re-tread market.

- One tonne contains around 140 casings.
- The average re-tread car tyre saves approximately 4 gallons of oil compared to new.
- One gallon of oil is equivalent to 8.18 kg of CO<sub>2E</sub>.
- The average re-tread tyre costs £21.

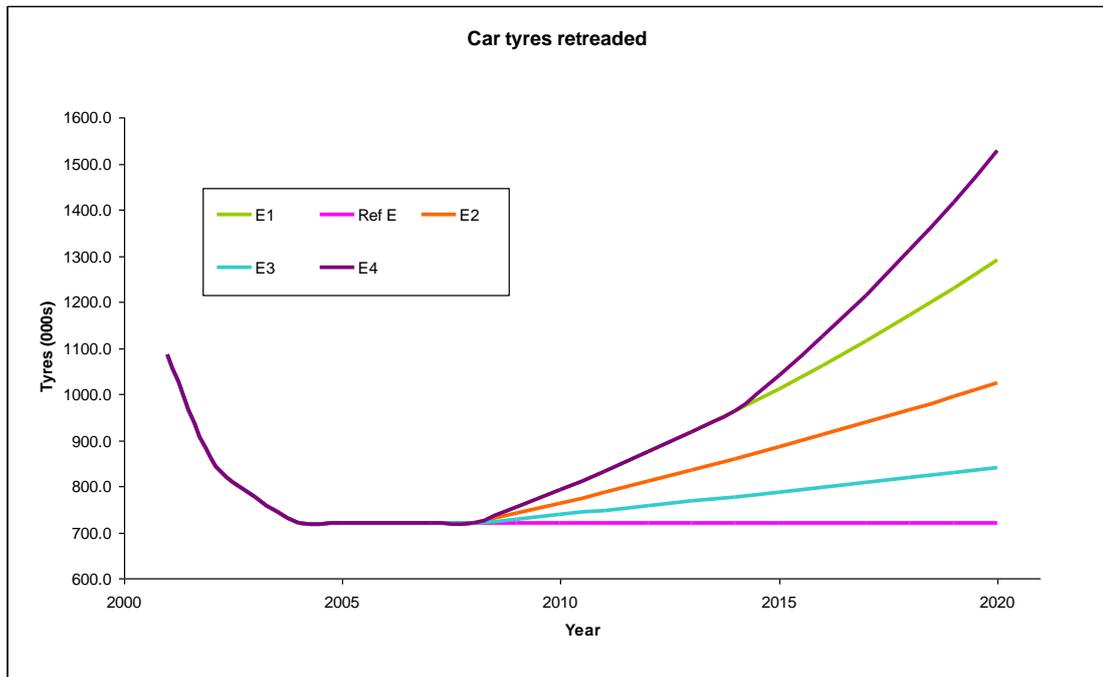


Table 3: Scenario assumptions

Tyres							
Scenario	Overall output and assumptions	Possible policy interventions	Casings reman (M)	Casings reman (kt)	CO <sub>2</sub> E (kt)	£M	Oil savings (Mlitres)
Ref E	Data based on predictions made by WRAP. Sales of car re-treads remains constant at 2005 levels of 719,000 tyres per year	None	11.5	81.6	376.5	241.6	207.1
E1	The car re-tread industry increases at 5% per year after 2008 (lag due to time required to implement recommendations). This is an optimistic projection similar to those made by the RMA.	Full implementation of the recommendations above.	14.8	105.6	487.4	312.8	268.1
E2	The car re-tread industry increases at 3% per year after 2008. Same as E1 but with lower outputs.	Promotion of the green advantages of re-tread. Some local government policy changes to favour re-treads.	13.4	95.0	438.1	281.1	133.8
E3	The car re-tread industry grows inline with car use at 1.35% after 2008.	Some local government policy change.	12.2	87	401.5	257.7	207.1
E4	Similar to E1 up to 2015 where the tyre re-tread industry increases at 8% per year.	Same as E1, but the price of disposal and oil costs makes re-treaded tyres more attractive.	15.6	111.0	512.0	328.6	281.6



Figure 3: Scenario impacts



### Scenario Ref E

The data is based on the latest used tyre arisings figures from WRAP. This model assumes that the level of car tyre re-treading will remain constant at the current (2005) value of 719,000 tyres per year. Even this, in comparison to historical data, may be optimistic as there has been a significant drop in the number of car tyres remanufactured over the last five years. Even at this low base (approximately 2% of all car tyre arisings) this sector gives the largest energy and materials savings of all five product groups studied.

### Scenario E1

This model assumes a good uptake in re-tread tyres across all three target groups. This would probably be achieved by involving three of the BREW funded bodies (WRAP, MTP, the Carbon Trust and Envirowise) in collaboration with the RMA. This model would result in an approximately 80% increase over 15 years in the number of re-treaded tyres bought in the UK. This (and all) models assume that the implementation of these recommendations will not take effect until 2008.

### Scenario E2

This assumes that the growth in this sector is led mainly by the 'green' consumer with some governmental change in policy towards Local Government fleet tyre usage. This would probably be implemented with the Carbon Trust, WRAP and MTP in collaboration with the RMA. This scenario would result in an



approximately 40% increase within 15 years in the number of re-treaded tyres bought in the UK.

### **Scenario E3**

This is a baseline scenario with little intervention from environmental bodies to increase the use of re-treaded tyres. Small changes to Local Government procurement could encourage the uptake of re-treaded tyres at this rate (equates to 1.35%).

### **Scenario E4**

This scenario is similar to E1. However it assumes that environmental factors such as increases in oil prices, demand for new tyres and cost of disposal of tyres all increase, either through the development of foreign economies or implementation of governmental policies on disposal and recycling. To model this rise in demand, the increase in sales increases from 5% per year to 8% per year in 2015.

## 8 Summary

Truck re-treading is a well established industry which thrives in the cost conscious commercial fleet market. However, there appears to be very little room for growth in this market. Conversely the car tyre re-tread industry only occupies a niche section of the market. This sector struggles to compete with the imported budget tyres and also suffers from a poor image. However, there is a significant potential for growth in this market and, due to its size, would result in significant savings in terms of CO<sub>2E</sub>. The aerospace industry has been successfully re-treading its tyres for decades. If the car re-tread industry can send the message that the tyres they are producing are a quality product, then there is significant potential for this market to grow.

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<sup>1</sup> Slater S (2006) Used tyre market 2004, Oakdene Hollins

<sup>2</sup> Turner G (2003) Yorkshire forward. Resource efficiency and greenhouse gas emissions, Enviros Ltd.

