Centre for Remanufacturing & Reuse

The carbon footprint of retreaded versus new light commercial vehicle tyres

This paper has been produced from a report by Best Foot Forward commissioned for the Centre for Remanufacturing and Reuse. Access to the original document can be obtained on request.

Carbon Footprint

This report compares the carbon footprint of a new and a retread 17.5" tyre for use by light commercial vehicles. Retread tyres are tyres where a new tread is applied to a used tyre casing. This process effectively increases the number of cycles of use for a tyre casing.

This study shows that the manufacture of a 17.5" new tyre produces 86.9 kg CO_2 emissions compared to 60.5 kg CO_2 for an equivalent retread tyre, a saving of 26.4 kg. These figures are based on each retread tyre being resurfaced an average of 1.3 times (supplied directly by a remanufacturer). This equates to a reduction of emissions by 30%.

Table 1 shows that the retreading process generates over 70% less emissions than production of a new tyre. The impacts of production of a new tyre casing must, however, be included in the overall footprint (without the tyre casing retreading cannot occur). Indeed, the impacts of production of a new tyre casing accounts for almost 70% of total retread impacts (including end of life). As expected, the majority of the carbon saving from retreading is the result of reusing a tyre casing. With each reuse cycle, the impacts of the casing (manufacture and end of life) are amortised over the multiple use cycles which therefore reduces the net carbon emissions.

Table 1: Carbon footprint of a new and a retread tyre

	New tyre		**Retread tyre**					
			Retread total		**Reuse of Casing**		**Retreading process**	
Total impact	**kg CO_2**	**%**	**kg CO_2**	**%**	**kg CO_2**	**%**	**kg CO_2**	**%**
Materials	48.6	55.7	31.1	51.2	21.1	55.6	10.0	43.9
Transport	9.9	11.3	8.3	13.7	4.3	11.3	4.0	17.7
Energy	31.4	36.0	22.5	37.1	13.6	35.9	8.9	39.0
Waste	-0.1	-0.1	-0.1	-0.2	0.0	0.1	-0.2	-0.7
End of life	-2.5	-2.8	-1.1	-1.8	-1.1	-2.8	-	-
Total carbon footprint	**87.2**	**100**	**60.7**	**100**	**38.0**	**100**	**22.7**	**100**

Note: numbers may not add up due to rounding.

The breakdown of the carbon footprint in Table 1 allows comparison of impacts arising from different product stages. It shows that the embodied carbon of materials is the largest component for both tyres accounting for more than 50% of the total impact. It is responsible for 49 kg of CO_2 in new tyres compared to 31 kg CO_2 in retreads.

The second largest impact is attributed to the energy needed in the manufacturing and retreading process. The energy used to manufacture a new tyre produces 31 kg CO_2, while retread energy is 22 kg CO_2.

The footprint of transport is roughly the same for both tyre types. In total transport emissions add almost 10 kg CO_2 for a new tyre and over 8 kg CO_2 for a retread. The higher emissions for transport of new tyres come from the long distance import of raw materials from overseas.

In total the impact of production waste from both tyres is low. The production process generates very little waste and the waste rubber material is useful in other applications with little additional processing.

End of life emissions are determined through analysis of the final fate of casings. In some instances, waste tyres may reduce carbon emissions through substitution. This is illustrated by the largest net saving[1] being derived from displacing coal with tyres as a fuel in cement kilns.

[1] Disposing of tyres is not a 'carbon positive' activity as such. The study accounts for the impacts of producing tyres at earlier life cycle stages and these are significant. However, when examining end of life only, net savings can be attributed to tyres through displacement of other fuels/materials.

Materials Saving

Tyre manufacturers produce different tyre types for different weather conditions, loads and road conditions. To make a tyre suitable for most conditions manufacturers use composite/blended materials so it is very difficult to typify an "average" tyre. The composition of the new tyre used for this study is based on publicly available sources and the authors recognise that the robustness of the study would be improved with direct data from manufacturers. Conversely, data on material needed for a tyre retread is based on information provided directly by a retreader. The type and quantities of material inputs are presented in Table 2 below.

An extra 17.6 kg of raw material is required to manufacture a new tyre over a remanufactured one. The savings are due to the reuse of the casing (effectively reusing the steel and textile components) which are a substantial part of a tyre's structure and weight.

Table 2: Structure and weight of material components needed for manufacturing a new and a retread 17.5" tyre

	New tyre		**Retread tyre**	
Material	**Weight (kg)**	**Structure (%)**	**Weight (kg)**	**Structure (%)**
Synthetic rubber	3.8	14.5	3.3	37.4
Natural rubber	8.1	30.5	0.3	3.7
Carbon black	5.8	22.0	3.0	33.5
Steel	6.6	25.0		
Rayon/polyester	0.5	2.0		
Plasticizers (oils and resins)			1.8	20.2
Zinc oxide	0.3	1.0		
Sulphur	1.3	5.0		
Other			0.5	5.2
Total	**26.5**	**100**	**8.9**	**100**

Conclusion and further work

This study has found that retreading tyres is more environmentally beneficial than buying new. Retreading reduces carbon dioxide emissions by 26.4 kg and gives a material saving of 17.6 kg. Currently, approximately 130,000 light commercial vehicle tyres (which are 17.5" or above) are retreaded annually in the UK, this equates to an approximate saving of 3400 tonnes of CO_2 and 2,300 tonnes of material.

Further research into this area could include:

- improved accuracy on the data source for new tyre production, which was sourced from secondary sources and manipulated to apply to 17.5" tyres
- collecting retread data from more manufacturers to account for variations
- data on performance in use of retread versus virgin tyres.