



Creating markets for recycled resources

# UK Used Tyre Market 2004

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# SECTION A: EXECUTIVE SUMMARY

## Introduction

This report is the result of a detailed study of the UK Used Tyre Market in 2004 carried out by Oakdene Hollins Limited (OHL) for the Waste and Resources Action Programme, (WRAP). It was carried out between September 2005 and January 2006 and was based on initial input from the Used Tyre Working Group (UTWG), under the chairmanship of the Department for Trade and Industry (DTI). Assistance was obtained from the Environment Agency (EA), the Scottish Environment Protection Agency (SEPA), the Northern Ireland Environment and Heritage Service (EHS) and from many stakeholders in the manufacturing, distribution, collection and processing sectors of the OEM and used tyre industries, in particular from the key trade associations:

Tyre Recovery Association (TRA)  
British Rubber Manufacturers' Association (BRMA)  
Retread Manufacturers' Association (RMA)  
Imported Tyre Manufacturers' Association (ITMA)  
National Tyre Distributors' Association (NTDA)  
Motor Vehicle Dismantlers' Association (MVDA)  
British Vehicle Salvage Federation (BVSF)  
Society of Motor Manufacturers and Traders (SMMT)  
Automotive Consortium on Recycling and Disposal (ACORD)

The assistance of all stakeholders is gratefully acknowledged.

The basic categories of used tyres in this analysis are based on the type of vehicle from which the tyres are derived. These are as follows:

**Cars.** Covering two wheel drive passenger cars and car derived vans. For simplification, the small quantities of tyres from motor cycles and three wheeled vehicles, where separately identifiable, are included in "cars".  
**4x4 Cars.** Four wheel drive passenger cars.  
**Light commercial vehicles (LCV).** All other goods vehicles up to a gross vehicle weight (gvw) of 3,500 kg  
**Trucks and Buses.** Medium and heavy goods vehicles and buses  
**Other.** Covering tyres on vehicles not included in the above categories, in particular agricultural vehicles and earthmovers. Many of these tyres are not covered by the disposal ban resulting from the Landfill Directive.

The figures do not include aircraft tyres. These are high specification, high value tyres which are retreaded many times, mainly in Belgium. Given the relatively low volumes of these tyres and the specialist nature of this process they are not included in the used tyre arisings for this report.

## Methodology

It was clear from the outset that considerable modelling of arisings and recovery/disposal data was required to arrive at figures that could be relied upon with a high degree of confidence. Assumptions made in the base data and in the modelling were sense checked where possible from alternative sources and with alternative models. Where quantities are considerable, for instance in used tyre arisings for cars based on replacement tyre sales, a greater degree of alternative modelling was used to ensure that the best estimates were obtained.

The latest market figures that were published by the UTWG were for year 2003. At the outset of this study, the tyre arisings figures for 2004 had not been finalised by the UTWG. The planned methodology was initially to comment on the draft figures but these were delayed due to missing data on landfilling and non-affiliated collectors. OHL worked closely with DTI to gather the missing data directly whilst progressing general market information from other sources. The UTWG figures were first drafted at the beginning of January 2006, and by way of a final check, the OHL findings were compared with these in order to determine any significant differences and to carry out some rationalisation between the two sets of figures.

Identified "gaps" in the UTWG figures for 2003 were:

- No allowance had been made for larger tyres such as those fitted to agricultural and earthmoving equipment.
- The conversion factors used, particularly for car tyres replaced on in-use vehicle, were deemed by the industry

- to be understated, as car tyres have become, on average, larger in recent years.
- The estimates of tyres remaining on end of life vehicles was overstated. The pending End of Life Vehicle Directive was starting to encourage greater recovery of tyres prior to dismantling and shredding of the vehicles.
- Export figures did not appear to include a significant quantity of tyres shipped abroad with the vehicle.
- Figures from non identified activities, such as stockpiling, fly tipping and secondary re-use, were rounded quantities and not sufficiently justified.
- The probable cause of unaccounted arisings was not justified but entered as a balancing figure.

Taking additional data from a number of sources, the gaps identified were minimised. Examples of such data sources were the use of an analysis of tyre content in auto shred residue, carried out by a major salvage company, and the results of a 400 vehicle study of end of life cars and vans, carried out on behalf of the DTI.

## Findings

Flow charts are provided in the Appendices which summarise the findings in quantitative terms by both tonnage and numbers of tyres. These are broken down into the above categories where possible. Given the assumptions used in the calculation of both arisings and recovery and disposal figures, it is not deemed sensible to present them to an accuracy of below 100 tonnes or 10,000 units. Calculations presented in the text are therefore rounded at the summary stage for presentation on the flow charts. In a number of cases, apparent errors in addition are caused by this rounding.

The analysis results are summarised as follows:

Arisings	'000 Units	Weight, '000 tonnes	% of Total by Weight
Car	38,910	268.8	56.0%
4x4	1,960	24.5	5.1%
Light Commercial Vehicle	2,960	32.1	6.7%
Truck and Bus	2,840	130.7	27.2%
Other	200	14.4	3.0%
Not categorised	980	9.8	2.0%
<b>Totals</b>	<b>47,850</b>	<b>480.1</b>	<b>100.0%</b>

Recovery and disposal	Weight, '000 tonnes	% of Total by Weight
Re-use as part worn	30.8	6.4%
Re-use as retreaded	49.4	10.3%
Other Temporary Re-use	3.1	0.6%
Release from Stockpiling and Fly tipping	(0.5)	(0.1%)
Exported	33.1	6.9%
Landfill Engineering	29.0	6.0%
Material Recovery (Shred crumb, powder)	171.8	36.2%
Energy Recovery (cement)	71.6	14.9%
Other Permanent Re-use	11.5	2.4%
Losses to landfill in ASR	35.0	7.3%
Other Disposal	50.3	10.5%
Less exported part worns and retreads	(5.0)	(0.1%)
<b>Totals</b>	<b>480.1</b>	<b>100%</b>

The arisings are further broken down by country based on vehicle registration information, as follows:

Arisings	Weight, '000 tonnes	% of Total by Weight
England	393.8	82.0%
Scotland	36.0	7.5%
Wales	21.9	4.6%
Northern Ireland	18.1	3.8%
Imported etc.	9.8	2.0%

It is noted that the figures presented in this report are the result of an independent study of the 2004 used tyre market in the UK carried out by OHL for WRAP.

Market data for used tyre arisings and disposal in the UK will continue to be provided annually by the UTWG and it is their figures that are seen by the secondary tyre industry and by WRAP as being the official market data. However, as noted above, considerable liaison between OHL and the UTWG has resulted in very close correlation between the two sets of figures for 2004.

# SECTION B: ARISING

## 1 Introduction

The models used for assessing the weight of tyre arisings are largely based on quantities of tyres rather than on their weights. To this end an average weight of the mix of used tyres in each category of vehicle has to be established in order to convert units of tyres into tonnages. In recent years, however, tyres on new passenger cars have become heavier due to increased performance requirements and to the trend towards larger cars. This may also be true for other categories of vehicle. It is important, therefore, to re-assess the conversion figures that have been used by the industry in the past in order to arrive at more accurate assessments of tonnage.

Arisings of used tyres and tyre derived material in the UK are from the following sources:

**Replacement.** Displaced by replacement tyres fitted on in-use vehicles. Replacement tyres can be new, part worn, re-grooved, or retreaded.

**Imports.** Mainly imports of used tyres but including some tyre shred.

**ELV.** Available on end of life vehicles (ELVs), whether or not removed from the vehicles.

**Other.** Tyres released from temporary stocks, either after secondary re-use or after stockpiling or fly tipping.

These sources are considered in turn in the following sections.

# 2 Replacement Tyres for Cars and 4x4 Cars

## 2.1 General

For the purpose of analysis of tyre arisings, cars are split into two categories, namely two wheel drive (2WD) passenger cars (including small vans) and 4 wheel drive (4x4) cars. Small vans tend to have similar tyre sizes to those on passenger cars from which the vans are derived. However, 4x4 cars have consistently larger tyres and are therefore considered separately.

Motorcycle tyres are not recorded separately within the used tyre industry. However, using distance travelled per tyre as a guide to used tyre arisings, motorcycle tyres represent less than 0.5% of tyre arisings by units, even less by weight, and are therefore included, where identifiable, in the car tyres data.

## 2.2 Car Tyre Conversion Factors

As stated in Section 1, it is important to re-assess the average weight of used tyres collected. Whilst the retail tyre industry charges for disposal by number of units, the collection industry passes on to processing and disposal operators by overall weight. Conversion factors for the 2003 UTWG used tyre arisings data for passenger car and 4x4 car tyre weights were 6.5kg and 13.75kg respectively. These are considered in terms of number of tyres per tonne, i.e.

Passenger Car	154 tyres per tonne
4x4 Car	73 tyres per tonne

Actual data received from a questionnaire survey of collectors and processors who were not members of the Tyre Recovery Association (non-TRA) in November 2005 gave an average car tyre weight of 7.6kg, or 132 per tonne. This figure included 4x4 car tyres. Given that, on average, 4x4 tyres are c.1.8 times the weight of conventional car tyres and that they represent c.5% of the total tyres in this category (based on replacement tyre sales data and on vehicle registrations from Appendix III), the current average tyre weights can be calculated.

Further data were received from the results of the recent 400 end of life (ELV) vehicle study commissioned by the DTI. These were all "natural" car and van ELVs, i.e vehicles that had come to the end of their useful life and were beyond economical repair.

This data is compared to that taken from other industry sources in the following table:

Source	Tyres per tonne, Passenger Car	Tyres per tonne, 4x4 Car	Comment
Non-TRA Returns	137	76	From average 132
Sapphire Energy Recovery	140	78	From average 135
Vellco	130	80	Car figure includes LCV 15" rimmed
Michelin	141	73	Actual reported
DTI 400 ELV Study	162	N/A	Actual survey (excluding LCVs)

It is logical to assume that used tyres displaced by new tyres at retail outlets are on average heavier than those remaining on natural end of life vehicles. This is because:

- They will tend to have more tread remaining (assuming that tyres on older cars are allowed to wear further before replacement than are those on newer vehicles).
- They will be larger tyres for later cars for the reasons identified.

By excluding the ELV figures from the above table, the conversion factors are seen to be, sensibly, comparable and confirm that the average weights used historically for car and 4WD are now too low.

For modelling used tyre arisings from replacement tyre sales, the reported figure given by Michelin is taken for passenger cars, i.e.141 per tonne. This eliminates the approximation used in breaking out 4x4 and LCV tyres from the other reported figures. The Vellco and Michelin figures are averaged to arrive at the best estimate for 4x4 at 77 per tonne. In summary:

Passenger Car	141 tyres per tonne
4x4 Car	77 tyres per tonne

For natural ELV tyres, the findings of the DTI study for 2WD passenger cars are used, i.e: 162 per tonne. The ratio of 4x4 to 2WD weights is used to estimate the equivalent figure for 4x4 cars. In summary:

Natural ELV Passenger Car	162 tyres per tonne
Natural ELV 4x4 Car	90 tyres per tonne

A final category of vehicle is "premature" ELVs, i.e. those which have been written off by insurance companies as the result of accidents. It is likely that the available tyres on these vehicles will, on average, be both heavier originally and will be less worn than on the older scrapped cars. Given that premature ELVs represent a considerable proportion of the overall sources of used tyres, a further set of conversion factors is required. For these, an average weight is taken which assumes 50% wear from current new tyre weights. In summary:

Premature ELV Passenger Car	132 tyres per tonne
Premature ELV 4x4 Car	73 tyres per tonne

## 2.3 Calculation of Replacement Arisings

### 2.3.1 General

Given the significance of the arisings of used car tyres from the replacement trade, these are modelled from a number of sources of information as set out below.

### 2.3.2 Replacement tyres based on new, retreaded and part worn tyre sales from industry data

Data providing the exact number of replacement tyres sold in the UK are not available and have to be estimated based on actual returns provided by the Trade Associations and from their member's estimates of non-affiliated companies' sales. Returns from RMA, ITMA and BRMA affiliated members give the sales of replacement tyres, including an estimate for part worns, into the UK market in 2004. These are converted into tonnages as set out in Appendix I:

Car	169,441 tonnes
4x4	16,406 tonnes

Industry based estimates of sales of replacement tyres by non-affiliated companies need to be added to these tonnages to arrive at best overall estimates. For 2WD cars, the adjustments are between zero and 37% to the sales of new tyres. An average adjustment of 18.5% is used as set out in Appendix I. For 4X4 cars, an estimate is first made of the use of part worn tyres, which was not in the industry supplied figure. The basis of this is set out in the following paragraph. The industry based adjustment of 5% is then applied to the new total.

These adjustments provide the following estimates:

Car	200,788 tonnes
4x4	17,226 tonnes

Within the adjustment figure for 2WD cars is an allowance for a greater number of used tyres displaced by part worn tyres. As set out in Appendix I, the BRMA estimate for this activity was 1.5million units in 2004, whereas another reputable industry estimate (see Section 2.3.4 below) put the quantity of tyres at 2.5 million units. The majority of part worn tyres are those removed from end of life vehicles, and the calculations to assess this in detail are set out in Section 7 and Appendix V of this report. Here the figures show that arisings are nearer 3 million tyres for 2WD cars and a further 150,000 for 4x4 cars. However, it is also noted that approximately 2.5 million used tyres, of all categories including part worns, were exported in 2004, as detailed in Section 10.2.5, and there is therefore no direct link between part worn recovery quantities and arisings from their use as replacements. However, the two sets of figures should be comparable. The adjustment factor used for 2WD cars takes the likely higher quantities of part worn replacement tyres into account. For 4x4 cars a nominal 50,000 part worn tyres is added to the replacement sales figure.

### 2.3.3 Replacement tyre arisings based on distance travelled and tyre life

The National Road Traffic Survey for 2004 estimates the distances travelled by each category of vehicle based on national roadside surveys. This is multiplied by the number of road wheels on the vehicle category to arrive at tyre distance travelled. The figures are detailed in Appendix II. Given the nature of the surveys, the distances are not broken

down into car and 4x4. Taking the best industry estimate of average car tyre life of 48,000 km, the theoretical replacement frequency can be estimated.

Car tyre distance travelled	1,592 billion tyre km
Tyres replaced	33,200,000 units

This figure is split by the ratio of 2WD cars to 4x4 cars as calculated in Appendix III, namely 95.1% to 4.9% before applying the conversion figure to compute tonnage:

Cars	$33,200 \times 0.951 \div 141$	=	223,900 tonnes
4x4	$33,200 \times 0.049 \div 77$	=	21,300 tonnes

It has not been possible to verify the life of an "average" car tyre and therefore this figure, whilst providing a sense check on the figures modelled from other sources, should only be taken as indicative. It is also noted that statistics based on tyre wear will also affect end of life vehicle data.

### 2.3.4 Approximations based on other industry sources

Trend Tracker Ltd. is an independent statistical survey company working in the automotive sector. Based on data provided by industry sources, Trend Tracker estimates the used car (including 4x4 variants) tyre arisings as:

UK based "affiliated" tyre manufacturers	19.1m
Official imported figure	5.0m
Part worns	2.5m
Unaffiliated tyre manufacturers	1.5m
Parallel imports (e.g. wholesalers)	1.0m
Retreads	<u>1.0m</u>
Total	<u>30.1m</u>

Applying the above split between car and 4x4, this equates to:

Cars	$30,100 \times 0.951 \div 141$	=	203,000 tonnes
4x4	$30,100 \times 0.049 \div 77$	=	19,200 tonnes

### 2.3.5 Tyre Recovery Association and other returns

Returns from members of the Tyre Recovery Association (TRA) and from the independent survey of non-affiliated (non-TRA) tyre recovery companies provided the data set out in Appendix IV. This shows a recorded total of 236,850 tonnes of car and light truck tyres collected. (The published TRA returns did not distinguish between car, 4x4 car and light truck tyres). All of the major collecting companies and 15 smaller operators provided returns, leaving out only the low tonnage operators. It is confidently assumed that this represents of the order of 95% of all car and light truck tyres available. An extrapolation of these figures to allow for those companies that did not provide a return suggests that 249,300 tonnes of used car and light truck tyres were collected by the industry in 2004. Tyre distances covered by cars and 4x4cars represent 86.5% of this group of vehicles (Appendix II). It follows that the used tyre arisings data provided by this route for cars and 4x4 cars is:

$$\text{Cars and 4X4} \quad 249,300 \times 86.5\% = 215,640 \text{ tonnes}$$

Of which, approximately, 91.6% is passenger cars and 8.4% is 4x4 cars by weight of tyres:

Cars	$215,640 \times 0.916$	=	198,000 tonnes
4x4	$215,640 \times 0.084$	=	18,100 tonnes

## 2.4 Summary and Best Model

A summary of the above is set out in the following table. Figures derived from the various sources are averaged to provide the best estimates overall.

	<b>Model</b>	<b>KTonnes car</b>	<b>KTonnes 4x4</b>
1	New, Retread and Part Worn Sales	200.8	17.2
2	Tyre Life (ref. only)	223.9	21.3
3	Independent	203.0	19.2
4	Collector Returns	198.0	18.1
	<b>Average, excluding Tyre Life</b>	<b>200.6</b>	<b>18.2</b>

These figures are converted back to units using the revised conversion factors. The following table summarises the arisings of car and 4x4 tyres in 2004 from replacement tyre sales:

	<b>'000 Units</b>	<b>'000 tonnes</b>
<b>Car</b>	<b>28,280</b>	<b>200.6</b>
<b>4x4 car</b>	<b>1,400</b>	<b>18.2</b>

# 3 Replacement Tyres for LCV

## 3.1 General

This category covers all commercial vehicles below 3,500 kg gross vehicle weight (GVW) but excluding car derived vans. Tyre sizes are generally greater than for passenger cars. This is a relatively small source of used tyres and there are fewer sources of data to assess the tonnage arisings.

## 3.2 LCV Tyre Conversion Factors

The 2003 UTWG Used Tyre Arisings data showed an average of 10.9 kg per tyre (92 tyres per tonne).

Actual returns received from the non-TRA member survey showed an average of 53 tyres per tonne in this category. This figure is seen as erroneous and is being checked. Other current estimates of the average weight of tyres for this category come from Michelin at 11.36 kg (88 tyres per tonne). Based on the Vellco data in Section 2.2, and on the known mix of LCV tyres to car tyres, the average LCV tyre is 11.25 kg, or 89 tyres per tonne. The DTI 400 vehicle ELV study included 19 LCVs on which the tyres averaged 10.33 kg, or 97 tyres per tonne.

A best figure of 90 tyres per tonne is taken for average weight of a replaced LCV tyre. The DTI's higher figure of 97 per tonne for end of life LCVs suggests that, as with cars, tyre treads tend to be more worn down on average at the point of scrapping of the vehicle than they are at the point of replacing a tyre on an in-use vehicle. This higher figure is therefore used when considering ELV arisings.

In summary:

LCV	90 tyres per tonne
ELV LCV	97 tyres per tonne

## 3.3 Calculation of Arisings

### 3.3.1 Replacement tyres based on new, retreaded and part worn tyre sales from industry data

As for the assessment of car tyre arisings, see Section 2 above, returns from RMA, ITMA and BRMA affiliated members give the sales of replacement tyres, including an estimate for part worns, into the UK market in 2004. These are set out in Appendix I. For LCVs the actual returns suggest the arisings to be:

LCVs	19,370 tonnes
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Adding the industry estimates of non-affiliated companies' sales of c.10 % gives:

LCVs	21,307 tonnes
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### 3.3.2 Used LCV tyre arisings based on distance travelled and tyre life

The National Road Traffic Survey provides distances travelled for "Light Vans" which includes both car derived vans and LCVs. The distance mix of each sub category of van cannot be estimated sufficiently accurately to use this method as a basis for calculating used tyre arisings for LCVs.

### 3.3.3 Tyre Recovery Association and other returns

The returns from members of the Tyre Recovery Association discussed in section 2.3.5 above did not provide a split between car and light commercial vehicle tyres. Unlike for car tyre arisings, given the small percentage of these tyres that will be from LCVs, a small error any assumptions made can lead to a large error in arisings calculated. This is not therefore seen as a reliable model for calculating LCV tyre arisings.

### 3.4 LCV Summary

The best estimate of light commercial vehicle arisings from replacement tyre sales is therefore based on industry sales figures. These are therefore:

	'000 Units	'000 tonnes
LCV	1,920	21.3

# 4 Replacement Tyres for Truck and Bus

## 4.1 Truck and Bus Tyre Conversion Factors

This category covers all commercial vehicles above 3,500 kg gross vehicle weight (GVW), buses and coaches. Tyre sizes are considerably greater than for passenger cars and there is a relatively greater variation in tyre weights. The 2003 UTWG data showed average 49.0 kg per tyre (20.4 tyres per tonne) for heavy truck tyres and 21.5 kg per tyre (46.5 tyres per tonne), for medium trucks.

New estimates of the average weight of tyres for this category come from a number of sources as follows:

<b>Vellco</b>	Average 50kg each (20 tyres per tonne) for the larger (22½ inch rims) but no weight was available for the smaller 17 inch wheels, which will reduce the average overall weight.
<b>Bandvulc</b>	Average weight of tyres received for retreading is 50 to 55 kg, say, 52.5 kg each (19 tyres per tonne).
<b>Michelin</b>	Medium Truck at 26.5kg each (38 tyres per tonne) and Heavy Truck and Bus at 48.9kg each (20.4 tyres per tonne).
<b>Trade returns</b>	The November 2005 questionnaire survey of non TRA members showed an actual average weight of truck and bus tyres of 45.7kg (21.9 tyres per tonne) collected.

From the above, it is noted that there is no obvious trend towards heavier truck and bus tyres, as there is for car tyres. The Michelin and non-TRA return figures are seen to be the most representative of the industry. By assuming an arisings mix of 10/90 between medium and heavy truck tyres, the Michelin average weight would be 46.4kg. The average of this and the non-TRA figure is 46kg per tyre (21.7 per tonne). This is taken as the best overall estimate for 2004 for both replacement and ELV modelling.

## 4.2 Calculation of Arisings

### 4.2.1 Replacement tyres based on new, retreaded and part worn tyre sales from RMA/ITMA/BRMA data

As for cars, see Section 2 above, returns from RMA, ITMA and BRMA affiliated members give the sales of replacement tyres, both new and retreads, into the UK market in 2004. These are set out in Appendix I. For medium and heavy truck and bus tyres these returns suggest the arisings to be:

Tyres	2,323,008 units
Tonnage	107,051 tonnes

Adding the industry estimates of non-affiliated companies' sales and part worn replacements at c.5 % gives;

Tyres	2,439,158 units
Tonnage	112,404 tonnes

### 4.2.2 Used truck & bus tyre arisings based on alternative modelling

It is noted (Appendix II) that truck and bus tyres do 310 billion tyre kilometres per year. Assuming an average life to replacement of 130,000 kilometres, this would yield a used tyre arising figure of 2.38 million tyres at a weight of 117,000 tonnes. However, it has not been possible to verify the life of an "average" truck tyre and therefore this figure, whilst providing a sense check on the figures modelled from replacement sales, should only be taken as indicative.

Actual TRA and non-TRA returns show a total of 66,849 tonnes collected in 2004. If this is extrapolated, as with car figures, to allow for the fact that this figure represents c.95% of all truck tyres collected, then the adjusted figure would be 70,400 tonnes. However, many truck tyres will not enter the UK tyre collection market since the industry is largely based on fleet tyre management programmes. A tyre management company will routinely replace worn tyres and will arrange for the displaced tyres to be re-grooved or re-treaded without entering the wider used tyre market.

It follows that alternative models for tuck tyre arisings from replacement sales are, again, not sufficiently accurate to be used to confirm the figure based on tyre sales data.

### 4.3 Truck & Bus Summary

Arisings based on replacement tyre sales data are seen as the most reliable model. The figures are therefore as follows:

	'000 Units	'000 tonnes
Truck & Bus	2,440	112.4

# 5 Replacement Agricultural and Other Tyres

## 5.1 Tyre Conversion Factor

This is a minor category of tyres, albeit that individual units on vehicles such as earthmovers and tractor drive wheels can be heavy. An industry estimate average of 70kg per tyre (14.3 per tonne) is taken.

## 5.2 Calculation of Arisings

Based on returns from BRMA and ITMA, a total of 141,000 tyres were sold into this market in 2004. Assuming a conversion factor of 14.3 used tyres per tonne, this equates to a used tyre arising figure of 9,860 tonnes.

## 5.3 Agricultural/Other Summary

In summary, to the nearest 10,000 units and 100 tonnes:

	'000 Units	'000 tonnes
<b>Agricultural Etc.</b>	<b>140</b>	<b>9.9</b>

## 6 Used Tyre Imports

Imports of used tyres represent only a small proportion of total arisings. Figures are taken from the UK Trade Statistics database for 2004. This showed a total of 2,206,000 used pneumatic tyres imported, at a weight of 9,262 tonnes. The majority of casings are imported as part worns, or for retreading, with no significant casings being imported for disposal. There is also evidence of some tyre granulate and shred being imported for further processing. Nearly two thirds of imports were from Europe, with over one third coming from The Netherlands. The split of imports by main source country, by weight, was as follows:

Source	Percentage of Total	
European Union 25:		
Netherlands	36.1%	
Germany	16.7%	
France	4.9%	
Other EU 25	4.1%	
Total European Union 25		61.8%
Asia & Oceania (mainly Japan)		14.8%
North America (all USA)		8.1%
Other		15.3%
<b>Total Imports</b>		<b>100.0%</b>

As noted in the executive summary of this report, the figures do not include aircraft tyres. These are high specification, high value tyres which are retreaded many times, mainly in Belgium.

The import figures are not broken down by category of tyre, although imports are known to include both car and truck tyres. It is also noted that the figures show a very low average weight per tyre of 4.2 kg. It is therefore likely that they include smaller units such as scooter and trailer tyres. For the purpose of analysis, therefore, no attempt has been made to convert the weight figures into car, LCV and truck & bus categories. An estimate of total units is computed from the weight figure, based on the average overall weight of tyres from the aggregated calculations of arisings, i.e. 10.03 kg per tyre. It follows that the small quantity of granulated and shredded material being imported is here treated as whole casings.

In summary, imported tyres are estimated at:

	'000 Units	'000 tonnes
<b>Imports</b>	<b>930</b>	<b>9.3</b>

# 7 End of Life Vehicles (ELVs)

## 7.1 General

Tyres associated with vehicles that have reached the end of their economic life in the UK are disposed of in a number of ways:

- Spare tyres may be removed from the vehicle prior to shipment to the salvage company. These tyres will enter the used tyre market or will displace an equivalent tyre from another vehicle.
- The majority of tyres will be removed from the vehicle, particularly cars and LCVs, by the dismantler/salvage companies prior to de-pollution, baling and shredding. These tyres will also enter the used tyre market.
- Some tyres are not removed at the point of de-pollution of the vehicle and are baled and then shredded with the vehicle. These tyres are not subsequently recovered with the scrap metal and will therefore be disposed to landfill with the auto shredder residue (ASR).
- Some tyres are exported with the vehicle for continued use in countries with more relaxed vehicle controls. This is a significant “re-use” route for truck tyres.

In order to model the arisings of ELV tyres, the following data are collated:

- Number of ELVs occurring.
- Average number of tyres on vehicles at the point of dismantling.
- Average weights of tyres on vehicles.
- Number of tyres remaining on vehicles after de-pollution.

## 7.2 ELV arisings

A detailed analysis of arisings of tyres from the ELV chain is presented in Appendix V. The sources of data and the assumptions made in modelling the figures are set out below.

### 7.2.1 Number of ELVs

This is broken down by “premature” ELVs, i.e. those that have been written off by insurance companies as a result of an accident, and “natural” ELVs, being those vehicles that have been worn out to the extent that they are beyond economic repair. The licensing and transfer regulations managed by the DVLA have been tightened in recent years, and the ELV Directive is beginning to improve the accuracy of recording of salvage operations through the establishment of Authorised Treatment Facilities (ATFs). However, until the regulations are fully in force the number of vehicles in each category that were scrapped in any year has to be an estimated figure. The main reason for the inaccuracy of official DVLA data is the high number of unlicensed, usually older, vehicles that are in use. It follows that the number of expired licenses is not an accurate guide to the number of vehicles scrapped.

Data has been provided by the SMMT, the MVDA and by independent analysts who track the changes in registrations annually to build up databases by age of vehicle from which changes can be modelled. The number of two and three wheeled vehicles ELVs has been supplied and these are treated separately in the analysis. The tyres arising from these vehicles are included in the car figures at the summary.

### 7.2.2 Number of Tyres per Vehicle

It is assumed that passenger cars have 5 tyres. There is as yet no significant move to the use of “run flat tyres” which will eliminate the need for spare wheels in the future. It is assumed that, where vehicles are received by the dismantler without a full compliment of tyres, e.g. a passenger car without a spare, that the missing tyre has been removed by the last owner and passed into the used tyre market at an earlier stage.

Commercial vehicles have a varying quantity of tyres depending on axle configuration and number of wheels per axle. Axle configurations for heavy goods vehicles have been taken from Department for Transport (DfT) statistics (see Appendix II) and this has been supplemented by inputs from the tyre industry and by observation of vehicles on the road in order to assess the average number of tyres on each category of commercial vehicles.

### 7.2.3 Average Tyre Weights

Average weights of tyres on car and light van ELVs are taken from the recent 400 vehicle study commissioned by the DTI. As noted previously, naturally occurring ELV tyres tend to be lighter than those displaced during the life of the vehicle. However, for premature ELVs, it is likely that the available tyres will, on average, be both heavier and less worn than on the older scrapped cars. For these, an average weight is taken which assumes 50% wear from current new tyre weights. Weights for heavy commercial vehicles are assumed to be similar to the overall averages reported by the collection industry.

### 7.2.4 Tyres Remaining on the Vehicles after De-pollution - Cars

As the ELV Directive starts to take full effect in 2006, most tyres will be removed in order to assist the attainment of 85% material recovery from ELVs. However, based on discussions with a number of vehicle salvage companies, it is noted that many tyres are remaining on passenger car ELVs at the point of baling and shredding. These tyres are those that have no value in the market as part worns. They will therefore be shredded with the vehicle and subsequently disposed to landfill along with the other residues. The average number of tyres remaining fluctuates based on a number of factors, including the value of the scrap steel recovered and the labour cost of removal of the wheels and the tyres from the wheels.

Sims Group carried out an analysis of shredder waste in May 2004. From the figures it was deduced that, on average, approximately two tyres (40%) remain on vehicles and therefore go through to the shredder residue. A further recent trial suggested that three tyres (60%) remain. Both figures represent results from only small samples and therefore can only be used as a guide. EMR quoted that between 50% and 60% of tyres on ELV cars are un-recovered. However, anecdotal evidence from some smaller salvage companies suggested that this figure is between zero and two tyres remaining. A figure of 45%, i.e. just over two tyres per car, is taken as the best estimate of the percentage of tyres that were remaining on natural ELV passenger cars at the point of baling in 2004. This estimate is reduced to 10% for tyres removed from premature ELVs because they will, on average, be less worn and therefore have a significant re-use value. As noted, this situation was in place before the impact of the ELV Directive had started to take effect. The percentage remaining on all ELV cars will reduce significantly through 2005 and 2006.

Anecdotal evidence and industry estimates are applied to assess the approximate ratio of tyres on ELV cars that are reusable as part worns compared to those that will be scrapped. Again, this ratio is higher for tyres removed from premature ELVs.

### 7.2.5 Tyres Remaining on the Vehicles after De-pollution - Trucks and Buses and Other Tyres

In recent years, truck and bus salvage companies have been drawn into the regulations arising out of the ELV Directive. As a consequence, businesses have closed down and many old trucks are now exported, ("there is always a market for old trucks abroad, e.g. Poland"), broken up by the owners for spares, or passed to dismantlers who do the same thing, often exporting the vehicle as components. A large number of old trucks is taken abroad and sold off. The implications of this issue for tyre arisings and disposal in the UK are discussed later in this report.

Industry contacts confirmed that, for those trucks, buses and agricultural/earthmover vehicles being dismantled, the majority of tyres are removed prior to disposal. Depending on their quality, they go to re-use as part worn, retreads, export or recycling. A nominal figure of 10% is taken to account for any tyres that remain on scrapped vehicles. It is further estimated that 25% of available tyres are resold as part worn tyres in the UK or overseas, and that the balance of tyres removed is sent for retreading or recycling.

## 7.3 Summary ELV arisings

The arisings figures calculated in Appendix V are summarised as follows:

	Removed or Exported with Vehicle, '000 units	Remaining on Vehicle, '000 units	Removed or Exported with Vehicle, '000 tonnes	Remaining on Vehicle, '000 tonnes
Car	6,470	4,160	42.1	25.9
4x4 car	340	220	3.9	2.4
LCV	570	470	5.9	4.9
Truck & Bus	360	40	16.5	1.8
Other	60	0	4.5	0.0
<b>Totals</b>	<b>7,800</b>	<b>4,900</b>	<b>72.9</b>	<b>35.0</b>

# 8 Net Arisings from Other Sources

## 8.1 Stockpile clearance

The study of stockpiles of 1,000 tyres or more in England and Wales was carried out by AEAT in 2002. This is taken as the basis of the review of arisings from stockpiles. The base data for the study was an assessment of the number of tyres in each location. This has been converted to tonnage using the average weight of the current overall mix of used tyres based on the findings of this market study, i.e. 10.03 kg per tyre. On this basis, a total of 138,000 tonnes is stockpiled at 38 locations as shown in the following chart.

The study found that the majority of tyres, 136,000 tonnes or 98.4%, are at just 8 locations, with the remaining 2,000 tonnes spread across the remaining 30 sites.

Consultant ERM, who is carrying out new a study, has found no evidence of new stockpiles since the AEAT study, and their expectation is that the existing stockpiles have not increased in size. It is unlikely that the major site at Knighton, in Powys, which alone contains two thirds of all stockpiled tyres, will be cleared in the foreseeable future. Just one of the other major sites has been cleared to date, as have two minor ones. These clearances, amounting to a total of 106,500 tyres, were carried out in 2003 and 2004. Taken at the average overall weight of 10.03 kg per tyre, and assuming an equal split between the two years, the arisings figure from this source in 2004 is:

$$106,500/2 \times 0.01 = 530 \text{ tonnes}$$

Even if the clearance rate is stepped up in the near future, the additional arisings from this source will remain low. Based on this evidence, it is taken that arisings, or disposals, from or to stockpiles in Scotland will also be insignificant relative to the major sources. Finally, the Northern Ireland Environment and Heritage Service is not aware of any permanent stockpiles in NI.

In summary:

	'000 Units	'000 tonnes
<b>Stockpile clearance</b>	<b>50</b>	<b>0.5</b>

## 8.2 Fly tipping

The Environment Agency provides statistics, from their fly capture database installed in April 2004, of the number of incidents of fly tipping of tyres occurring per month. This averages at approximately 2,100 incidents per month. However, the early months' figures need to be discounted because they may not have been based on 100% returns from the authorities. Also, the database does not include non-reported "business to business" incidents such as tips on tyre retailers' forecourts, which are cleared, for quickness, through the legitimate collector services at the expense of the retailer. Only a little over 1% of the incidents - the larger ones - get reported to the Agency who can then provide quantitative evidence. The remaining reports do not give an indication of the quantities of tyres involved in each case, nor do they identify where fly-tipped tyres have been cleared as part of a mix of wastes.

A qualitative study of tyre distributors commissioned by the NTDA in August 2003 was inconclusive. It showed that:

- 38% of respondents had had tyres tipped on their premises in the past 6 months and
- 49% of respondents believed the number of fly-tipping incidents to be increasing, but the balance believed it was either static or decreasing.

One major retailer suggested that tyres are tipped on their premises 250 to 300 at a time "every one to two months". There are 20,000 retail tyre outlets in the UK.

An indication of the tonnage of fly tipped tyres in the UK at any point in time could be empirically deduced from the number of incidents, as follows:

Local Authorities plus Agency. Say 2,200 incidents per month at 150 tyres each incident. Assuming clearance within one week, this equates to 4 million tyres per year or 76,000 tyres that would be in fly tips in the UK at any one time.

Retailers' surveys. Say, 38% of 20,000 sites have two incidents per year at 275 tyres each incident. Assuming clearance within 1 week, this would account for a further 4.2 million tyres per year or 80,000 tyres in retailers at any one time.

In summary, assuming an average mix of tyres (at 10 kg average per tyre):

Total tyres fly tipped per year	8.2 million tyres or 82,000 tonnes
Total fly tipped "stock" at any point in time	156,000 tyres or 1,600 tonnes

Clearly this gives an order of magnitude only and further work is required in order to quantify the figures.

From discussions with local authorities and with waste management companies, it is noted that fly tips, whilst being a serious issue in terms of cost and detriment to the environment, are cleared on a regular basis, and the tyres collected are taken to waste management operators for legal disposal and subsequent entry into the used tyre market. It follows that there is no net gain or loss of tyres from fly tipping in any one year.

### 8.3 Other arisings

Anecdotal evidence from farmers and local authorities suggested that there is no net accumulation or reduction of the number of whole tyres used in temporary secondary applications such as agricultural, safety and leisure use. Farmers will have a stock of tyres that is maintained for use as silage clamps etc, but do not accumulate tyres for this purpose. Go-kart race tracks will similarly use tyres as temporary safety barriers, but these will be cleared, and the tyres returned to the market when the track is closed. Again, therefore, it is noted that there is no evidence of either a significant increase or reduction in tyre arisings from these temporary secondary applications.

## 9. Arisings by Country

It is assumed that tyre arisings occur in the country in which the vehicle is registered. Whilst this may not be totally accurate, particularly for truck tyres, given the significant presence of national truck fleets, it is believed that used tyre arisings can be approximately broken down by each of the four countries in the UK through the application of the mix of vehicle registrations in each country.

Registration details are derived from Department for Transport (DfT) statistics. Given that the figures are used to proportion tonnage arisings, the extent of licence evasion does not affect the figures, assuming similar levels of evasion in each country. Neither do the DfT figures break car registrations down into 2WD and 4X4. In this case the same proportion per country is assumed for each category

The analysis is set out in Appendix X and is summarised below.

	<b>Weight, '000 tonnes</b>	<b>% of Total by Weight</b>
England	393.8	82.0%
Scotland	36.0	7.5%
Wales	21.9	4.6%
Northern Ireland	18.1	3.8%
Imported etc.	9.8	2.0%

# SECTION C: RECOVERY AND DISPOSAL

## 10 Recovery and Disposal

### 10.1 Definitions

#### Recovery

The removal of a used tyre from the wheel of the vehicle and its collection for either re-use or processing for new applications.

#### Re-use

The use of a tyre for its original purpose, i.e. as a part worn tyre or after regrooving or retreading.

#### Disposal

Tyres that are not used either for their original purpose or in alternative applications and are incinerated or sent to landfill. In the context of a national study of material flows, exporting the tyre is also a form of disposal.

### 10.2 Recovery and disposal Options

#### 10.2.1 General

The recovery and disposal options for used tyres are divided into temporary and permanent routes.

The former covers options which only temporarily remove the tyres from the waste stream such as re-use of the tyre for its original purpose as a part worn tyre on another vehicle. Similarly, regrooving and retreading are methods to extend the life of the original tyre. Stockpiling and fly tipping also represent temporary disposal options for used tyres. Other options use whole tyres for alternative applications such as boat and dock fenders, silage clamps at farms, race track barriers and the like. In all of the examples quoted, the use of the tyre is only a temporary removal from the waste stream and the tyre will eventually find its way back into the used tyre market for permanent recovery. Clearly there is a time element involved with the delay between original recovery and ultimate processing ranging from, for example, a few days for the clearance of fly tipped tyres to many years in the case of marine use or agricultural applications and for some stockpiles.

Permanent recovery or disposal implies that the tyre is removed from the tyre industry, either through processing into a form which will have a use in a new application or by permanent disposal to incineration or landfill.

These recovery and disposal options are summarised in the following table:

Temporary	Permanent
Re-grooving and Part Worns	Export
Re-Treading	Landfill Engineering
Other temporary (e.g. silage clamps, boat fenders, sports safety barriers, etc.)	Material Recovery (The recovery and processing of tyre rubber for new applications through shred, crumb and granulate)
Stockpiling	Raw Material (Carbon Black, Oils, etc.) and Energy Recovery
Fly Tipping	Energy Recovery through incineration (cement manufacture co-combustion)
	Other permanent (e.g. sea and river defences, etc)
	Landfilling etc.

The quantities of tyres going through each route in 2004 are modelled from a number of sources. These are:

- Actual returns from TRA members
- Questionnaire based surveys of non-TRA members
- BRMA estimates
- Discussions with other industry stakeholders such as salvage companies and tyre retailers.
- Questionnaire based surveys of landfill sites
- Web searches.

The analysis of these inputs is set out in Appendix VI. Issues and assumptions involved in the calculations are reviewed in the following sections.

### 10.2.2 Re-grooving and Part Worns

Re-grooving is a regular method used for extending the life of a truck tyre. One industry source estimated that some 55% to 60% of truck tyres are re-grooved and re-used before they go to retreading. However, it is illegal for passenger car tyres. Re-grooving is considered alongside part worn tyres for the purpose of analysis. Because of the nature of the trade in part worn tyres, the tonnages of tyres that are re-used, either with or without re-grooving can only be estimated from anecdotal evidence.

Anecdotal evidence suggests that up to 5% of tyres displaced by new tyres at a retailer still have some legal tread left on them and therefore have a value as a part worn tyre. Whilst it is noted that the industry discourages the practice, it is assumed that 50% of these, 2.5% overall, are sold on as part worns.

It is clear that a vehicle which is beyond economic repair, either through age or through an accident, will, in general, still have some useable tyres. It follows that the greatest majority of part worn tyres will arise from the ELV industry. Given the changes in tyre sizes over the past 15 years, many of these tyres will only be suitable for older vehicles or for export. Appendix V assesses the quantities and weights of part worn tyres, based on estimates taken from within the industry, of the percentages of re-usable tyres removed from vehicles prior to salvage. A higher percentage of re-useable tyres is assumed for premature ELVs.

After adding the above estimates of the tonnages of re-usable tyres that are removed from in-use cars and light trucks, the total part worn figures are as follows:

	2.5% Replacement, Tonnes	From ELV, Tonnes	<b>Total Part Worns, Tonnes</b>
Car	5,117	16,283	<b>21,400</b>
4x4	475	1,531	<b>2,006</b>
Light Truck	582	1,079	<b>1,661</b>
Truck & Bus & Other		5,697	<b>5,697</b>
<b>Total</b>	<b>6,174</b>	<b>24,590</b>	<b>30,764</b>

This represents, in units:

	2.5% Replacement, '000s	From ELV, '000s	<b>Total Part Worns, '000s</b>
Car	721	2,482	<b>3,203</b>
4x4	37	129	<b>166</b>
Light Truck	52	105	<b>157</b>
Truck & Bus & Other		116	<b>116</b>
<b>Total</b>	<b>810</b>	<b>2,832</b>	<b>3,642</b>

### 10.2.3 Retread Manufacture

Information supplied by the RMA and BRMA gives the numbers of retreaded tyres produced in the UK by category of vehicle. (For cars, the figure is split between 2WD and 4WD by the ratio of new vehicle registrations over ten years, as set out in Appendix III). Industry estimates have been applied to account for sales from non-affiliated sources. The tyre casings feedstock for this production can be assessed from the production figures using average tyre weights as follows:

	Units/Conversion Factor	Total Retread, Tonnes
Car retreads	766,225 units at 141 per tonne	<b>5,434</b>
4X4 retreads	39,480 units at 77 per tonne	<b>513</b>
Light Truck retreads	74,052 units at 90 per tonne	<b>823</b>
Truck retreads	917,000 units at 21.7 per tonne	<b>42,250</b>
Agricultural/Earthmover	4,766 units at 14.3 per tonne	<b>332</b>
<b>Total tyres to retread manufacture</b>		<b>49,352</b>

It is noted, as for part worn tyres, that many retreaded tyres manufactured in the UK are exported, see Section 10.2.5. It follows that the above quantities of tyres providing the feedstock for this production are not directly comparable with the arisings based on retread sales.

### 10.2.4 Temporary Agricultural and Recreational Use

Based on TRA returns, only 0.11% of tyres collected were sent to farmers or for marine and recreational uses in 2004. This was the equivalent of 476 tonnes only. The Viridis Survey in Northern Ireland, however, showed that 16%, or 2,600 tonnes went to "farmers for e.g. silage clamps" in the Province in 2002. Given the relatively small figure in this case, the total of 3,100 tonnes is taken for the UK as a whole in 2004.

### 10.2.5 Export

The official export figures for used tyres are taken from the UK Trade Statistics database for 2004. This showed a total of 2,453,000 used pneumatic tyres exported, at a weight of 20,556 tonnes, equivalent to an average unit weight of 8.38kg, which is credible.

To this must be added a considerable quantity of used tyres, on ELV vehicles that are reported by the salvage industry to be exported on the vehicles. This is particularly true of trucks, and the tonnage of tyres being exported by this route is significant. No accurate records can be found for this export activity and therefore the tyres content of the vehicles can only be modelled as follows. UK Trade Statistics show a total of c13,300 used trucks and buses exported out of a total of 48,679 used vehicles exported in 2004. This is equivalent to 25% of all ELV truck and bus arisings in that year. Whether or not the exported used vehicles are all ELVs, their export will remove the associated tyres from the UK recovery market. It is likely that further tyres will be in vehicle parts shipments, not recorded as tyres, but the figures would be offset by some imports of used vehicles. For modelling purposes, therefore, the used vehicle export figures are taken as the best guide to ELV tyre exports. Figures are analysed in Appendix VII and suggest a total of 9,088 tonnes tyres are exported with the vehicles.

Finally it is noted that a significant number of retreaded tyres, manufactured in the UK, are exported, thereby removing the casings from the permanent UK recovery market. Figures are based on RMA returns as follows;

Car retreads	222,583 units at 141 per tonne	= 1,579 tonnes
Light Truck	6,710 units at 90 per tonne	= 74 tonnes
Truck	4,827 units at 21.7 per tonne	= <u>1,760 tonnes</u>
<b>Total</b>		= <b><u>3,413 tonnes</u></b>

In total, therefore, the tonnage of tyres exported is:

	Tonnes
Used tyres exported	20,556
Exported on vehicle	9,088
Retreaded casings exported	3,413
<b>Total Exported</b>	<b>33,057</b>



### 10.2.10 Landfill Engineering and Recorded and Unrecorded Disposal

A detailed questionnaire based survey of landfill sites in England and Wales was carried out on behalf of the DTI in November 2005. This established the recorded tonnage of tyres going to landfill for both engineering purposes and for disposal in 2004. This was supplemented by actual landfill returns from the Scottish Environment Protection Agency (SEPA) and by anecdotal evidence of the disposal of tyres in Northern Ireland from the Environment and Heritage Service (EHS). The figures for recorded landfilling are as follows:

<b>Landfill Engineering</b>	<b>29,001 tonnes</b>
<b>Landfill Disposal</b>	<b>21,988 tonnes</b>

Disposal of tyres to landfill also occurred in 2004, in advance of the ELV Regulations, through the ASR, as discussed in Section 7 and detailed in Appendix V, as follows:

<b>ASR Disposal</b>	<b>34,954 tonnes</b>
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A particular feature of the situation in Northern Ireland has been the burning of tyres on open bonfires in 12<sup>th</sup> July commemorations. A 2002 study by Viridis showed that 30% of tyre arisings in the Province are unaccounted for. These are presumed by the EHS to have been either burned or exported to the Republic of Ireland or to mainland UK, and that this situation had not changed by 2004. Based on overall arisings of 16,000 tonnes in the Province, this suggests that 4,800 tonnes might have been burned or exported in 2004.

From anecdotal evidence from both the waste management industry and the used tyre industry it is understood that significant quantities of whole tyres are being disposed into landfill as part of mixed municipal solid waste (MSW). One major waste management company the North East of England suggests that this route accounts for some 250t to 500t per annum for that company in that region. The mechanism for this is discussed below.

Local Authorities are required by law to take used tyres from a member of the public where they are genuinely being disposed of as part of a household's bulky waste. To this end, operators of civic amenity sites have separate containers for the legal depositing, of any tyres brought in by the public. It is possible, however, that some of these tyres will find their way, unnoticed, into containers taking general waste. Similarly, private skip hire companies may not notice tyres that have been placed in the bottom of a hired skip before it is filled with general waste. In either case, if the tyres are noticed at the waste transfer station or at landfill reception, then the load should be rejected. It is believed, however, that this is not always the case, especially when the tyres represent only a small fraction of the total waste load. If not picked up, the tyres will find their way into landfill with the remainder of the load. There is no way of measuring these quantities accurately, although the practice is likely to diminish with time as the various regulations take full effect.

Compositional analyses of MSW in Great Britain in recent years have quantified unique waste streams down to as low as 0.1% by weight. These have shown that tyres are not an identifiable element of MSW. It suggests that the quantity of tyres in MSW nationally was noticeably below 36,000 tonnes in 2004.

The "unaccounted" difference between the arisings and recovery and disposal tonnages in this report amounts to 17,000 tonnes (Market Flow Chart Appendix VIII). Whilst considerable care has been taken in calculating the figures, with sense checks and alternative models used where possible, it is noted that a number of assumptions were made in the modelling process. The figures presented must therefore be seen as the best estimates within a small range of outcomes. Given that the "unaccounted" tonnage is a small difference between two large numbers, its accuracy can be questioned.

Clearly, however, if stockpiles, fly tipping and other temporary recovery activities are not on the increase, then the 17,000 tonnes of "unaccounted" tyres must be going to disposal through landfilling. This quantity is the equivalent of only 5 or 6 tyres per day per active landfill site in the UK and it can therefore be hypothesised that they are, indeed, being landfilled as part of the routine disposal of MSW.

The unrecorded quantities are summarised as:

<b>Northern Ireland, burned or exported</b>	<b>4,800 tonnes</b>
<b>Likely landfilled with MSW</b>	<b>17,000 tonnes</b>

## 10.3 End Product Applications for Recovered Material

### 10.3.1 General

As identified in Section 10.2.6 above, a total of 171,800 tonnes of used tyres are processed into shred, crumb and powder for further processing into a range of new end products for a variety of applications. The significant applications in the UK are categorised as follows:

- Horticulture. Loose shred and crumb for weed control and soil amelioration
- Road Repair. Rubber modified asphalt for road surfacing and repair
- Bound Play and Sports Surfaces. Construction of soft, bound rubber surfaces for applications such as children's playgrounds, pathways and sports tracks
- Loose Surfaces. Shred and large crumb for equestrian ménages, play surfaces and pathways.
- Moulded Products. Crumb and powder used in a wide variety of moulded products such as street furniture and railway crossing panels.
- Carpet Underlay.
- Construction Products. Shredded rubber used as aggregate replacement in construction products.

Stakeholders within the processing sector were not able to provide industry estimates of the various end use market sizes. The market sizes for these applications are therefore estimated from reports provided by a number of key processors. In assessing these markets, it is necessary to first break the materials available into car and truck/bus tyres, since they have different inherent structures and the recovered materials are, therefore, not directly interchangeable, especially for the grades of material that go into bound surfaces and moulded products.

The average compositions of the two predominant types of tyre are as follows:

	Car	Truck & Bus
Rubber and Additives	75%	65%
Steel	20%	31%
Textiles	5%	4%
Total	100%	100%

Currently only "ambient" grinding technology is available in the UK on a commercial scale. This entails initially shredding the tyres into, say, 100mm to 200mm strips, and then passing the shred through a series of increasingly fine mechanical grinding and sieving processes, with extraction of metals and fibres, to achieve the required quality of crumb or powder. The following analysis of markets considers only the rubber materials derived from this process, and not the fate of the steel and textiles recovered.

It must be stressed that the market sizes set out below are estimates only and are based on information from desk research and from key processors and end product manufacturers in the used tyre industry. They are based on average estimates for recent years, applied to the 2004 arisings tonnages.

### 10.3.2 Truck and Bus Tyres

Truck and bus tyres are, proportionately, more widely used than car tyres because they contain less textile. It follows that very few truck tyres will be sent to landfill or used in applications that require only simple processing, such as energy recovery. By considering the arisings and recovery of truck and bus tyres as detailed in Section B above and shown graphically in Appendix VIII, a balance of truck tyre material can be estimated as follows:

	'000 Tonnes	'000 Tonnes
<b>Truck Tyre Arisings</b>		<b>129</b>
Less:		
Re-use		(6)
Retread		(42)
Export		(16)
Landfill engineering		negligible
Energy recovery (cement)		negligible
Other use and landfill disposal		(10)
<b>Net Truck Tyres for Material Recovery</b>		<b>55</b>

This represents the weight of the feedstock tyres to the materials recovery sector. It is assumed that some 5% of each

material is lost in the conversion process. In order to calculate the net recovery of truck and bus tyre rubber the arisings tonnage is adjusted to allow for the mix of rubber in the feedstock (65%) and for the processing losses (5%) as follows:

$$55 \times 0.65 \times 0.95 = 34 \text{ ktonnes}$$

Evidence from the major truck tyre processing companies suggests that a small quantity of this material, say 1,000 tonnes, goes into moulded products, with the balance split 50/50 between sports and playground surfaces. In summary, the material derived from truck tyres is distributed as follows:

Moulded Products	1 ktonne
Sports surfaces	16.5 ktonnes
Playground Surfaces	16.5 ktonnes

### 10.3.3 Car Tyres

By subtracting the truck and bus tyre feedstock from the total tonnage going into material recovery applications, i.e. 172 ktonnes, it follows that the net tonnage of car tyres going into this sector is  $172 - 55 = 117$  ktonnes. In order to calculate the net recovery of car tyre rubber the tonnage is adjusted to allow for the mix of rubber in the feedstock (75%) and for the processing losses (5%) as follows:

$$117 \times 0.75 \times 0.95 = 83 \text{ ktonnes}$$

A large proportion of this material is used for all weather equestrian ménages and gallops. Evidence from a number of sources within the industry suggests that this business consumes of the order of 41 ktonnes per year. A similar, albeit minor, usage is in the surfacing of bridleways and pathways, estimated at a further 5 ktonnes. Another minor application, currently, is in road repairs, estimated at c. 4 ktonnes. A specific and significant usage is in the manufacture of carpet underlay which consumes approximately 17 ktonnes of material per year. No estimates of market size were available for horticultural and construction applications. However, from discussions with these sectors, it is estimated that they take the balance of car shred and crumb in the ratio of 60/40 respectively. In summary, therefore, the usage of car tyre material is approximately as follows:

Equestrian	41 ktonnes
Pathways	5 ktonnes
Road repair	4 ktonnes
Carpet underlay	17 ktonnes
Horticulture	10 ktonnes
Construction	6 ktonnes

# APPENDICES

- I RMA, BRMA, ITMA data
- II Tyre Mileage data
- III Vehicles in Use data
- IV TRA, non-TRA returns
- V ELV Analysis
- VI Fates Summary
- VII Export of Used Vehicles
- VIII Flow Chart, tonnes
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## Replacement Tyre Sales

## Appendix 1

### Numbers of Tyres

Combined RMA/BRMA/ITMA data for year ended 31st December 2004

Categories	RMA etc.	BRMA	ITMA	From Mkt. Report	Total	Mix
Car, New		16,385,077	5,443,804		<b>21,828,881</b>	
Car, Retread*	562,342				<b>562,342</b>	
Car, Part Worns, est.		1,500,000			<b>1,500,000</b>	
<b>Total Car</b>	<b>562,342</b>	<b>17,885,077</b>	<b>5,443,804</b>		<b>23,891,223</b>	81.4%
4 x 4		931,274	253,002		<b>1,184,276</b>	
4 x 4 Retread*	28,974				<b>28,974</b>	
4 x 4 Part Worns, est.				50,000	<b>50,000</b>	
<b>Total 4 x 4</b>	<b>28,974</b>	<b>931,274</b>	<b>253,002</b>	<b>50,000</b>	<b>1,263,250</b>	4.3%
<b>Light Truck</b>	<b>67,025</b>	<b>1,430,091</b>	<b>246,148</b>		<b>1,743,264</b>	5.9%
Med/Heavy Truck, New		1,209,462	201,546		<b>1,411,008</b>	
Med/Heavy Truck, Retread	912,000				<b>912,000</b>	
<b>Total Med/Heavy Truck</b>	<b>912,000</b>	<b>1,209,462</b>	<b>201,546</b>		<b>2,323,008</b>	7.9%
<b>Agricultural</b>		<b>130,293</b>	<b>10,440</b>		<b>140,733</b>	0.5%
<b>Total</b>					<b>29,361,478</b>	100.0%

\*Note: RMA figure split pro-rata to 2WD and 4WD registrations

Conversion Factors, Tyres per tonne	
Car	141
4 x 4	77
Light Truck	90
Med/Heavy Truck	21.7
Agricultural etc.	14.3

### Tonnages

Tonnes	
Car	169,441
4 x 4	16,406
Light Truck	19,370
Med/Heavy Truck	107,051
Agricultural	9,841
<b>Total</b>	<b>322,109</b>

### Adjustments for Non-Affiliated Companies

Allowance for non RMA/ITMA/BRMA

Tyres	Adjustment*		Tonnes	
Car	18.5%	28,311,099	Car	200,788
4 x 4	5%	1,326,413	4 x 4	17,226
Light Truck	10%	1,917,590	Light Truck	21,307
Med/Heavy Truck	5%	2,439,158	Med/Heavy Truck	112,404
Agricultural	0%	140,733	Agricultural	9,841
<b>Total</b>		<b>34,134,994</b>	<b>Total</b>	<b>361,566</b>

\* Adjustment: See body of report.

## Tyres Distance Data, Great Britain From National Road Traffic Survey, DfT 2004

### All Vehicles

	Tyres	Distance, Billion Veh. Km	% by Mileage	Distance, Billion Tyre Km
Cars	4	398.1	79.8%	1,592
Motor Cycles etc.	2	5.2	1.0%	10
LCV	4.1	60.8	12.2%	249
Other CV	See below	29.35	5.9%	260
Bus & Coach	4.1	5.2	1.0%	21
<b>Totals</b>		<b>498.65</b>	<b>100.0%</b>	<b>2,133</b>

Note: Figures are not available for Northern Ireland. From previous studies, the arisings in NI are estimated to be only 3.5% of the total for the UK. NI mileage is therefore not significant in this analysis,

### Medium/Heavy Goods Vehicles by Axle Configuration

	Axles	Tyres	Distance, Billion Veh. Km	% by Mileage	Distance, Billion Tyre Km
Rigid	2	5	11.75	40.0%	59
	3	7	1.92	6.5%	13
	4+	9	1.64	5.6%	15
Articulated	3,4	9	2.16	7.4%	19
	5	12	6.48	22.1%	78
	6	14	5.4	18.4%	76
<b>Totals</b>			<b>29.35</b>	<b>100.0%</b>	<b>260</b>

### Average Tyres Per Truck

	Axles	Tyres	Fleet Size, '000 units	% by Fleet Size
Rigid	2	5	253.0	57.3%
	3	7	43.4	9.8%
	4	8	26.3	6.0%
Articulated (Tractor + Trailer)	2+2	10	7.9	1.8%
	2+3	12	20.7	4.7%
	2+any	11	14.9	3.4%
	3+2	12	3.0	0.7%
	3+3	14	68.0	15.4%
	3+any	13	4.3	1.0%
<b>Totals</b>			<b>441.5</b>	<b>100.0%</b>
<b>Average tyres per truck</b>		<b>7.51</b>		

# Vehicles in Use 2004 and Ten Year Registrations

# Appendix III

## Vehicles in Use 2004

Source	SMMT* "on the road"	Pemberton "in use"	DfT "on the road"	DfT* "licensed"	DfT* "licensed " Plus Evasion	
Total Car	30,600,000	29,200,000		27,028,000	27,812,000	2.9% evasion
LCV*		2,900,000		incl.	incl. included in Car	i.e.PLG class includes LCV up to 3.5t GVW.
Rigid Truck			323,000	434,000	451,000	3.8% evasion
Articulated Truck			119,000			
Bus & Coach				100,000	101,000	0.9% evasion
Total Truck & Bus				534,000	552,000	

## New Registrations SMMT data

	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	Total ten years	% of Total ten years	% of Total 2004	% of segment ten years	% of segment 2004
2WD Car	1,864,939	1,947,157	2,089,014	2,148,645	2,098,689	2,122,435	2,337,213	2,426,049	2,419,906	2,387,830	21,841,877			95.1%	93.0%
4x4 Car	80,427	78,290	81,711	98,757	98,926	99,212	121,556	137,582	159,144	179,439	1,135,044			4.9%	7.0%
Total Car	1,945,366	2,025,447	2,170,725	2,247,402	2,197,615	2,221,647	2,458,769	2,563,631	2,579,050	2,567,269	22,976,921	88.3%	86.8%	100.0%	100.0%
2WD LCV	180,619	188,664	211,024	224,814	221,569	231,447	246,107	257,478	296,194	322,266	2,380,182			95.8%	97.8%
4x4 LCV	13,548	14,396	13,705	12,509	10,192	8,035	7,968	8,868	7,561	7,333	104,115			4.2%	2.2%
Total LCV *	194,167	203,060	224,729	237,323	231,761	239,482	254,075	266,346	303,755	329,599	2,484,297	9.5%	11.1%	100.0%	100.0%
Rigid Truck	33,799	33,151	30,228	35,431	33,628	35,517	37,279	35,135	36,788	37,461	348,417			61.5%	62.1%
Artic Truck	18,462	17,002	15,389	17,531	18,163	18,663	18,294	16,785	18,802	18,851	177,942			31.4%	31.2%
Bus & Coach	3,500	3,656	3,895	4,225	4,548	4,381	3,763	3,992	4,342	4,012	40,314			7.1%	6.7%
Total Truck & Bus	55,761	53,809	49,512	57,187	56,339	58,561	59,336	55,912	59,932	60,324	566,673	2.2%	2.0%	100.0%	100.0%
<b>Sub Total</b>	<b>2,195,294</b>	<b>2,282,316</b>	<b>2,444,966</b>	<b>2,541,912</b>	<b>2,485,715</b>	<b>2,519,690</b>	<b>2,772,180</b>	<b>2,885,889</b>	<b>2,942,737</b>	<b>2,957,192</b>	<b>26,027,891</b>	100.0%	100.0%		

Other

\*Notes:

Approx. 3% of cars are temporarily de-registered (Pemberton). SMMT cars figure at 97% is equivalent to 29,682,000 "on the road".

Note, c.1million motor cycles and scooters and c.2million other vehicles in special and exempt licensed categories

LCVs are all CVs up to 3.5t gvwt, including 4x4 utilities (4.2% only of total LCV registrations over 10 years)

## Used Tyre Collection Industry Returns

### Total Tonnage Collected and Disposed by or on behalf of TRA Members, 2004.

Collected	Tonnes	% of Total
Car	214,921	81%
Truck	48,043	18%
Other	2,491	1%
<b>Total in</b>	<b>265,455</b>	<b>100%</b>
Adjustment	19,545	
Adjusted Total	285,000	

Source: TRA/Excelar

### Tonnage Estimated from Non-TRA Member Returns, 2004

Collected	Tonnes	% of Total
Car	19,752	42%
Light Truck	2,177	5%
Truck	15,269	33%
Other	9,435	20%
<b>Total in</b>	<b>46,633</b>	<b>100%</b>

Source: DTI/Oakdene Hollins

## 2004 End of Life Vehicle Arisings

## Appendix V

Category	Number of Vehicles			Tyres per Vehicle Weight per Tyre		Total Tyres Available		Tyres Removed/Exported with Vehicle						Tyres Remaining and disposed with ASR				
	SMMT	Pemberton	Best Estimate	Units	Kg	'000s	Tonnes	Removed As Part Worn			Disposal/Export			Tyres Remaining and disposed with ASR				
								%	'000s	Tonnes	%	'000s	Tonnes	%	'000s	Tonnes		
Natural ELV Car		1,925,000	1,821,000															
Assume 95% by units 2WD			1,730,000	5.00	6.18	8,650	53,457	20%	1,730	10,691	35%	3,028	18,710	45%	3,893	24,056		
Assume 5% by units 4x4			91,000	5.00	11.13	455	5,064	20%	91	1,013	35%	159	1,772	45%	205	2,279		
Premature ELV Car*		375,000	375,000															
Assume 95% by units 2WD			356,000	5.00	7.57	1,780	13,475	40%	712	5,390	50%	890	6,737	10%	178	1,347		
Assume 5% by units 4x4			19,000	5.00	13.63	95	1,295	40%	38	518	50%	48	647	10%	10	129		
2/3 Wheeler	101,000		101,000	2.00	5.00	202	1,010	20%	40	202	35%	71	354	45%	91	455		
<b>All Car</b>	<b>2,297,000</b>		<b>2,297,000</b>			<b>11,182</b>	<b>74,301</b>		<b>2,611</b>	<b>17,814</b>		<b>4,195</b>	<b>28,221</b>		<b>4,376</b>	<b>28,266</b>		
<b>LCV</b>	<b>201,000</b>	<b>214,000</b>	<b>201,000</b>	<b>5.20</b>	<b>10.33</b>	<b>1,045</b>	<b>10,793</b>	<b>10%</b>	<b>105</b>	<b>1,079</b>	<b>45%</b>	<b>470</b>	<b>4,857</b>	<b>45%</b>	<b>470</b>	<b>4,857</b>		
HCV	48,500		48,500	7.51	46.00	364	16,755	25%	91	4,189	65%	237	10,891	10%	36	1,675		
Bus & Coach	4,500		4,500	7.51	46.00	34	1,555	25%	8	389	65%	22	1,010	10%	3	155		
<b>Total HCV &amp; Bus</b>	<b>53,000</b>	<b>53,700</b>	<b>53,000</b>			<b>398</b>	<b>18,309</b>		<b>100</b>	<b>4,577</b>		<b>259</b>	<b>11,901</b>		<b>40</b>	<b>1,831</b>		
<b>Other</b>	<b>16,000</b>		<b>16,000</b>	<b>4.00</b>	<b>70.00</b>	<b>64</b>	<b>4,480</b>	<b>25%</b>	<b>16</b>	<b>1,120</b>	<b>75%</b>	<b>48</b>	<b>3,360</b>	<b>0%</b>	<b>0</b>	<b>0</b>		
<b>Totals</b>			<b>2,567,000</b>			<b>12,689</b>	<b>107,883</b>		<b>2,831</b>	<b>24,591</b>		<b>4,972</b>	<b>48,338</b>		<b>4,886</b>	<b>34,954</b>		

Base Data References for Weights:

Natural ELV Car	DTI 400 vehicle ELV study
Premature ELV Car	Average of new and ELV
4x4 car is 1.80% of 2WD car	
2/3 Wheeler	Estimate
LCV	DTI 400 vehicle ELV study
HCV, Bus & Other	Industry Estimate

\* Note MVDA Estimate of number of premature ELV cars "350k" to 400k". Natural ELV figure is balance from SMMT total.

## Fates of Used Tyres Based on Industry Returns

## Appendix VI

Net arisings, i.e those handled by the collectors, are taken from detailed analysis, see body of report, as follows:

Total Arisings	480,100
Less	
Remaining on ELV	(35,000)
Exported with ELV	(9,100)
Other disposal	(21,500)
<b>Net Total Collections</b>	<b>414,500</b>

	TRA mix of "fates"	TRA tonnage from actual returns	Tonnage based on net total collections	Actual tonnage from other sources	Tonnage based on total collections	<b>Total Tonnages</b>
<b>TRA Member Returns</b>						
Material recycling (shred, crumb, powder)	41.45%	118,133	171,810		171,810	<b>171,810</b>
Use as an alternative fuel in cement manufacture	24.68%	70,338	102,299	71,635 Known collector(s)		<b>71,635</b>
Use in approved landfill engineering schemes	6.70%	19,095	27,772	29,001 DTI Landfill Survey		<b>29,001</b>
Landfill disposal of shred or oversized tyres	5.44%	15,504	22,549	21,988 DTI Landfill Survey		<b>21,988</b>
Retreading	3.03%	8,636	12,559	49,352 RMA data		<b>49,352</b>
Export for any of the above purposes	1.23%	3,506	5,098	20,556 UK Trade Statistics		<b>20,556</b>
Re-use as part worns	0.92%	2,622	3,813	30,764 See report		<b>30,764</b>
Other agricultural, marine or recreational uses	0.11%	314	456		456	<b>456</b>
Returned to original manufacturer	0.02%	57	83			
Supplied to a registered broker	11.50%	32,775	47,668			
Sold to a casing dealer	4.92%	14,022	20,393			
<b>Totals</b>	<b>100.00%</b>	<b>285,000</b>	<b>414,500</b>	<b>223,296</b>	<b>172,266</b>	<b>395,562</b>

Source: TRA/Excelar

### Reference Only:

	Non-TRA mix of "fates"	Non-TRA tonnages from actual returns
<b>Non-TRA member Returns</b>		
Material recycling (shred, crumb, powder)	91.19%	42,043
Use as an alternative fuel in cement manufacture	2.81%	1,297
Baled		845
Use in approved landfill engineering schemes	2.15%	993
Landfill disposal of shred or oversized tyres	0.04%	20
Sold to a casing dealer (assumed as part worns)	0.00%	
Retreading	0.49%	225
Export for any of the above purposes	1.47%	680
Re-use as part worns	0.00%	
Other agricultural, marine or recreational uses	0.00%	
Returned to original manufacturer	0.00%	
<b>Totals</b>	<b>100.00%</b>	<b>46,103</b>

Source: DTI/Oakdene Hollins

## Export of Used Vehicles

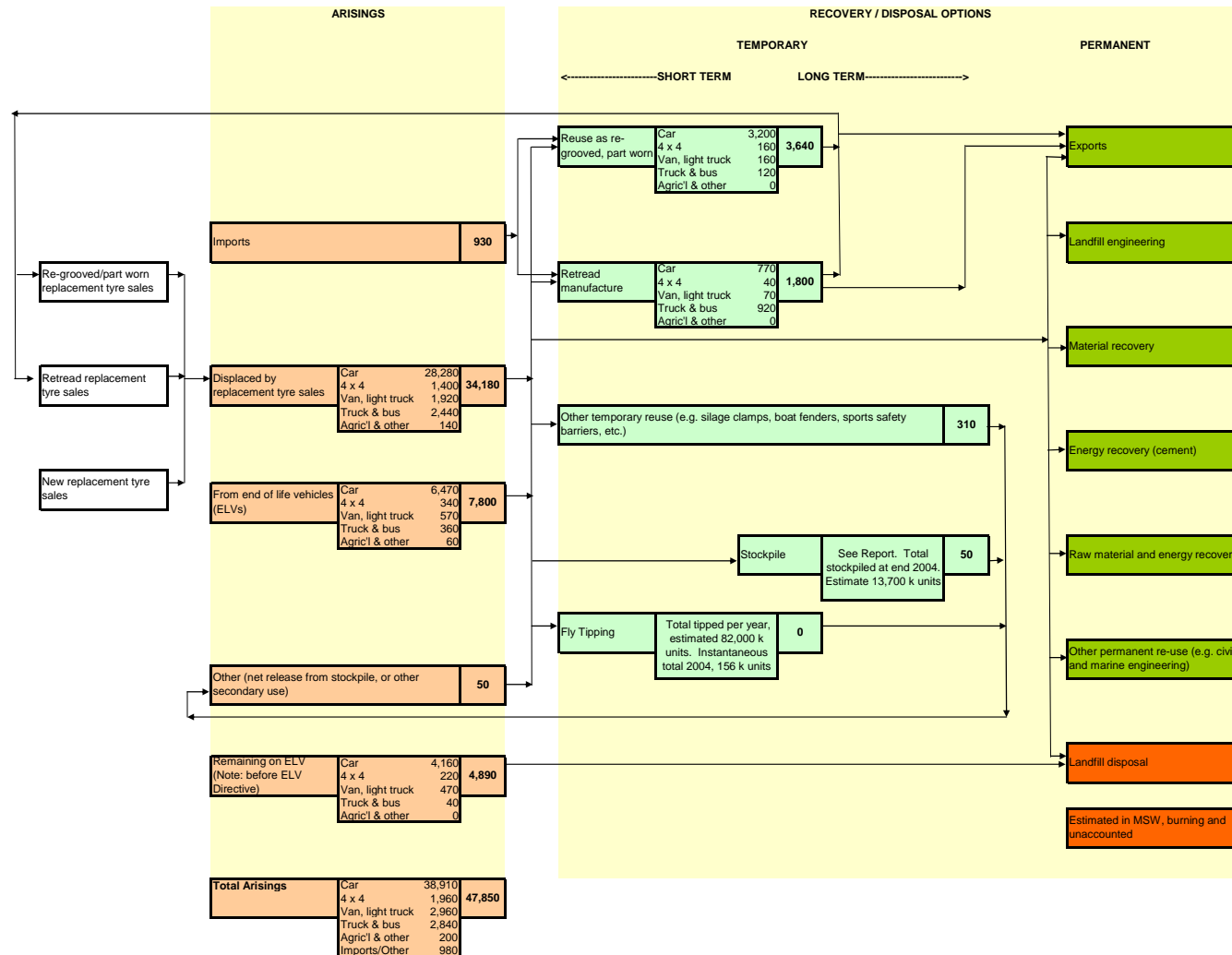
			No. of tyres	Total tyres	Unit Weight, kg	Total weight, tonnes
Tractor	9,149	9,149	4	36,596	70.0	2,562
Bus	899	899	4	3,596	46.0	165
Car	16,042	16,042	5	80,210	6.6	529
Van or Medium Truck	5,839					0
Assume 50/50 split, van	2,920	2,920	6	16,057	10.3	166
	2,920					0
Truck	9,485	12,405	7	86,832	46.0	3,994
Trailer	7,265	7,265	5	36,325	46.0	1,671
	48,679	48,679				9,088

Source: UK Trade Statistics



# UK Used Tyre Market Material Flows 2004 (Units)

# Appendix IX



All quantities in '000 units

Average conversion factor, (total tonnage 480.1 ktonnes) = 99.7 Tyres per tonne      10.03 Kg per tyre

## Arisings by Country

<b>England</b>			
	% of vehicles	UK Arisings	England Arisings
Car	84.0%	268.6	225.6
4x4	84.0%	24.5	20.6
LCV	84.5%	32.1	27.1
Truck & Bus	84.5%	130.7	110.4
Other	69.7%	14.4	10.0
<b>Total</b>		<b>470.3</b>	<b>393.8</b>

<b>Scotland</b>			
	% of vehicles	UK Arisings	Scotland Arisings
Car	7.5%	268.6	20.1
4x4	7.5%	24.5	1.8
LCV	5.2%	32.1	1.7
Truck & Bus	7.8%	130.7	10.2
Other	14.7%	14.4	2.1
<b>Total</b>		<b>470.3</b>	<b>36.0</b>

<b>Wales</b>			
	% of vehicles	UK Arisings	Wales Arisings
Car	4.8%	268.6	12.9
4x4	4.8%	24.5	1.2
LCV	4.9%	32.1	1.6
Truck & Bus	4.4%	130.7	5.8
Other	3.7%	14.4	0.5
<b>Total</b>		<b>470.3</b>	<b>21.9</b>

<b>Northern Ireland</b>			
	% of vehicles	UK Arisings	N Ireland Arisings
Car	3.7%	268.6	9.9
4x4	3.7%	24.5	0.9
LCV	3.7%	32.1	1.2
Truck & Bus	3.3%	130.7	4.3
Other	12.0%	14.4	1.7
<b>Total</b>		<b>470.3</b>	<b>18.1</b>

Tonnages in '000 tonnes

Source: Department for Transport