Statistics NEW ZEALAND Te Tari Tatau

What happens to a car when it reaches the end of its life?

Environmental effects of car disposal

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September 1998

Cover photographs courtesy of Dunedin City Council

Published in November 1998 by

Statistics New Zealand
Te Tari Tatau
Wellington, New Zealand

Catalogue Number 04.042.0098
ISBN 0-478-20703-4

Introduction

This article endeavours to explain what happens to a car at the end of its useful life and to highlight the environmental effects of this issue. It also looks at the disposal treatment of certain car parts in New Zealand. The car parts covered are by no means exhaustive, however, the areas covered will hopefully illustrate the general problem of car disposal and the associated environmental consequences.

New Zealand's vehicle stock

New Zealand is very much a society reliant on the motor vehicle. Over the past ten years the total number of licensed motor vehicles in New Zealand has increased 17 percent, from 2,179,005 in 1988 to 2,548,552 in 1998. There is a long-term trend in New Zealand of increasing vehicle numbers, and factors indicate that New Zealanders are using their motor vehicles more.[1]

With the increasing vehicle fleet, the ratio of the number of people per motor vehicle has gradually declined over the years. In 1992 there were 1.77 people per motor vehicle. This decreased to 1.70 people per motor vehicle in 1998. To put this another way - in 1992 there were 56.5 motor vehicles per 100 New Zealanders and in 1998 this increased to 58.9 motor vehicles per 100 New Zealanders. If current trends continue, it is estimated that by the year 2001, there will be 60.3 motor vehicles per 100 inhabitants. That equates to approximately 1.66 people per motor vehicle (see figure 1).

Table 1

Licensed Motor Vehicles

Year	Total Motor Vehicles (as at 31 March)			New Registrations (December year)		
	Total Vehicles	Private Cars	Private Cars as a percentage of Total Vehicles	Total Cars	Cars(1) previously registered overseas	Cars previously registered overseas as a percentage of Total Cars
1988	2,179,005	1,373,338	63.0	88,589	17,372	19.6
1989	2,217,259	1,430,805	64.5	134,828	50,965	37.8
1990	2,299,192	1,489,338	64.8	159,746	85,324	53.4
1991	2,349,269	1,539,809	65.5	102,966	47,351	46.0
1992	2,351,868	1,542,912	65.6	92,110	39,146	42.5
1993	2,379,417	1,562,134	65.7	97,663	43,841	44.9
1994	2,437,515	1,600,499	65.7	123,853	62,088	50.1
1995	2,487,727	1,647,134	66.2	146,656	80,976	55.2
1996	2,450,006	1,635,718	66.8	176,178	111,764	63.4
1997	2,457,116	1,675,301	68.2	155,599	97,041	62.4
1998	2,548,552	1,746,659	68.5	..	..	..

(1) Included in Total Cars

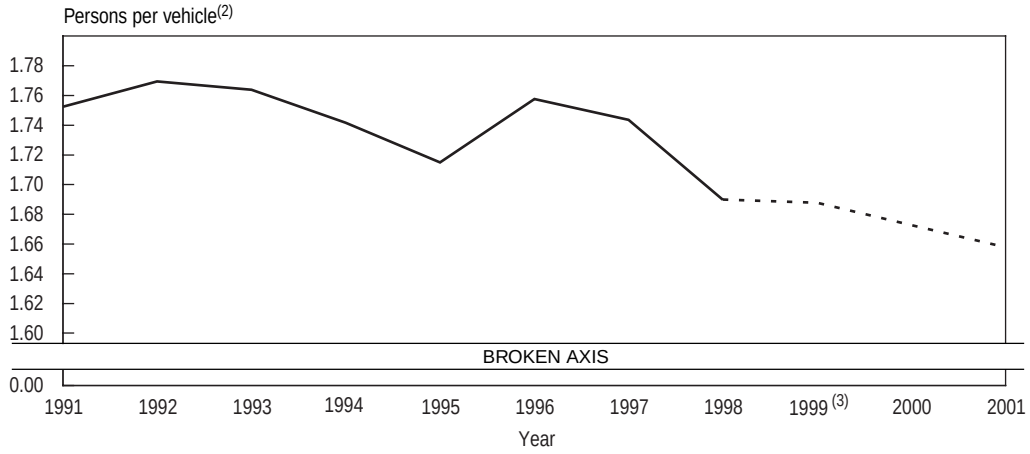
.. Figures not available

Source: Land Transport Safety Authority (LTSA).

[1] 1976 Census results indicated that under one half of the full-time labour force reported driving their car to work. However, approximately two-thirds (of the full-time labour force) reported doing so in the 1996 Census. Most other forms of transport to work, such as walking and using trains and buses, decreased.

Figure 1

Number of Persons Per Motor Vehicle(1)



(1) From 1991 to 1998, population estimates and motor vehicle figures are as at 31 March. Projections beyond 1998 are calculated using population projections as at 30 June.

(2) Excluding trailers and caravans.

(3) Projections for 1999 onwards are calculated using Projected New Zealand Resident Population figures (1996 base), using the medium projection variants for fertility, mortality and migration. Motor vehicle projections are calculated using an average percentage movement.

Source: Statistics New Zealand.

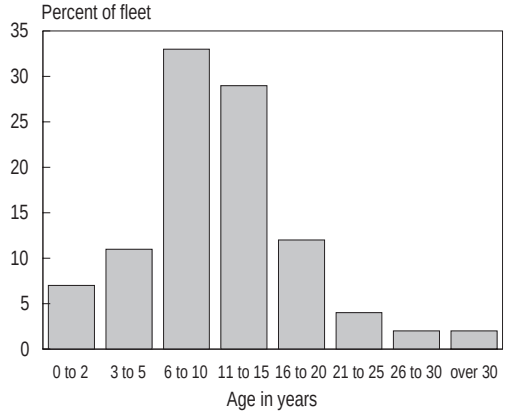
In 1995 there was a large increase in the total number of motor vehicles registered in New Zealand. This is reflected by a decrease in the ratio of number of people per vehicle (as shown in figure 1). There is no clear reason for this, but it could be exaggerated by a decline in private car registrations in the following year (1996). Table 1 shows that in 1996 the total number of motor vehicle registrations as at 31 March dropped from 2,487,727 in 1995 to 2,450,006 in 1996. According to a Transport Registry Centre spokesperson, this could be due to people holding back re-registering their vehicles, or choosing not to re-register their old vehicles at all and opting for a new vehicle (be it a second-hand import or a new car). Because motor vehicle license figures are as at 31 March (a snapshot in time), it is very hard to determine why the 1995 total vehicles licensed figure increased.

Motor vehicles have become increasingly accessible. In the 1980s New Zealand started to experience the second-hand car import phenomenon. A number of used cars were imported into New Zealand giving the average New Zealander the opportunity to buy a cheaper car. Demand grew for these cars, resulting in an extraordinary growth in the number of used car imports especially over the last four to five years. Initially, the cheaper used car imports priced the old cars off New Zealand roads. The New Zealand vehicle fleet initially became younger. However, as time progressed, the vehicle fleet started to age. People chose to purchase a used import as opposed to a new vehicle.

In 1988 16 percent of vehicles were less than three years old, however, by January 1998 only 7 percent were this age. The age of a national fleet affects the uptake of technological innovations (such as ABS brakes and airbags), the recyclability of vehicle materials, and emission levels. (New Zealand Auto Industry Fact File, 1997). It is interesting to note that in the United States of America the average age of scrapped cars is 11 years. However, in New Zealand, the average age of a scrapped car would probably be older, possibly falling between the range of 14 to 20 years.

Figure 2

The Age(1) of the Vehicle Fleet as at 1 January 1998



(1) As pertaining to the year of manufacture

Source: Land Transport Safety Authority - Transport Registry Centre

With the increase in the numbers of motor vehicles, the cheaper prices for new and used cars and the psyche of a 'disposable society', it has become easier to dispose of and replace a car that has reached the end of its useful life.

The exact volume of motor vehicles in New Zealand requiring disposal annually is unknown. However, there are indications that the number of vehicles requiring disposal is increasing. In an attempt to surmise the volume of cars requiring disposal, an approximation of the number of expired car registrations was calculated using the annual total car registration and new car registration figures. The table below gives a very rough indication of the number of expired registrations for cars only (in particular taxis, private and rental cars) and is not the attrition numbers of all motor vehicles.

Table 2 shows that in 1991 and 1995 there were substantial increases in the number of cars removed from registration. The highest rate of attrition, in 1991, equates with the removal of approximately 9.3 percent of the New Zealand car fleet. Over the last three years (March 1995 to March 1997 years), there has been a marked increase in the number of cars removed from registration.

Table 2

An Approximation of Car Attrition Numbers

Year ending 31 March	The number of expired car registrations(1)	Percent of car fleet
1988	33,456	2.4
1989	41,470	2.9
1990	87,486	5.8
1991	144,033	9.3
1992	82,056	5.3
1993	52,503	3.3
1994	55,358	3.4
1995	136,547	8.2
1996	112,204	6.8
1997	106,591	6.3

(1) An approximation of the number of expired registrations for taxis, private and rental cars.

Source: Statistics New Zealand.

Clearly, more cars are being disposed of than ever before. What happens to the old wrecks? Are we able to recycle cars? Perhaps not many of you have contemplated such questions, but these issues are becoming an increasing problem.

Motor vehicle disposal and recycling

There are so many components in a car that are of value, that vehicle recycling is not only a sound economic choice, but also an environmentally friendly one. Advantages to vehicle recycling include:

1. Energy savings and resource conservation - for example, reusing recycled steel requires half the energy and a fraction of the water needed to make new steel from iron ore.
2. Potential money savings - if the savings on energy are passed down to the consumer, recycled material or parts may be cheaper. Costs associated with using recycled and recyclable parts depends on the availability of such material.
3. Lessens the amount of debris going to landfill.

Some aspects of car recycling in New Zealand are very advanced (and comparable to developments in other parts of the world such as the United States and the United Kingdom), while other aspects of recycling car parts, such as tyres, appear to be underdeveloped.

Recent publicity about the increasing number of abandoned vehicles outlined the problems and costs involved in car disposal in a number of city centres. The number of abandoned vehicles has increased greatly over the past year, in most of the main city council areas (an exception being the Dunedin City Council area). There are a number of different strategies employed by councils with regard to the disposal of abandoned vehicles. Many councils are choosing to contract out the management of abandoned vehicles to external organisations. The annual costs associated with this problem vary from city to city and in the larger cities range from approximately $41,000 in the Christchurch City area, to in excess of $200,000 in the Auckland City area.

Councils believe that the upsurge in abandoned vehicles is largely due to the introduction of tougher standards for warrants of fitness (especially with regard to tightened rust checks) and cheap car imports (with owners preferring to dump an old car when costly repairs are required).

General overview of car disposal - the wrecking process

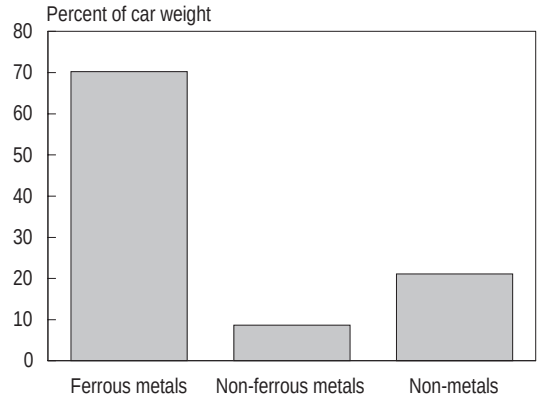
The average car is made up of a number of components. According to the American Automobile Manufacturers Association, the typical (intact) car weighs between 1,100 kilograms and 1,400 kilograms. Approximately 70 percent of this weight is from steel and iron (ferrous metals), 9 percent is made up of non-ferrous metals (such as aluminium, copper, lead, zinc) and 21 percent is made up of non-metals, such as plastic, rubber, glass and fluids (see figure 3).

The first step in the disposal story generally starts at the wrecker's yard. Normally, cars are taken to the vehicle dismantler (cars dumped at the landfill or abandoned are generally collected and delivered to a dismantler, to ensure the car is put through the

correct disposal procedures). According to a vehicle dismantler in Porirua, people may receive payment for their old cars. Depending on the age of the car and condition of the car parts (and whether the car can be driven to the yard or not), the dismantler may pay the vendor anything between $20 to $300 for the vehicle. However, if the vehicle is old (a 1982 model or older) or cannot be driven to the yard, then a dumping fee is charged (this can be around $25). The dismantler takes the car apart and keeps any saleable car parts. If tyres, batteries and car air conditioning units are in saleable condition, then these too will be sold as second-hand parts.

Figure 3

Components of a Car



Source: American Automobile Manufacturers Association

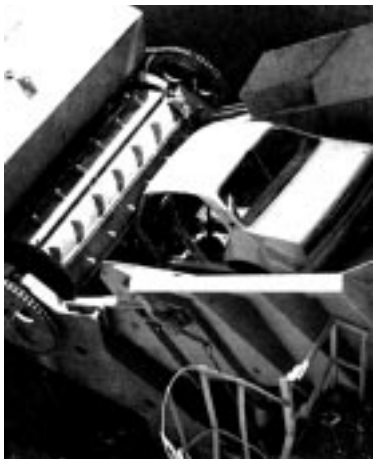
Once the shell/carcass of the vehicle has had all saleable parts removed, any unsaleable or hazardous parts removed, and hopefully all vehicle fluids drained, the body of the car is flattened by a mobile car flattener and transported to a scrap metal yard. Car bodies and other scrap metal from around the country end up at giant scrap yards - where metal is then crushed and shredded into fist-sized pieces.

Sims Pacific Metals Ltd, a large scrap metal shredding operation, has two metal shredding facilities in New Zealand. One in Christchurch yields approximately 20,000 tonnes of shredded metal per year, and another facility in Auckland yields approximately 40,000 tonnes per year. This very loosely equates to approximately 160,000 car bodies per year.

According to a spokesperson from Sims Pacific Metals Ltd, the operation of recycling car bodies has been in New Zealand since the 1980s. Before that most car bodies were bound for the landfill (in a compact/shredded form). It has been demonstrated that the recycling and baling of scrap metals extends the useable life of available landfill by up to 10 percent. Over the years the operation has experienced an increase in metal shredding, which can be attributed to the increase in used car imports.

At the shredders, the shell and unwanted car parts are shredded into small chunks which are sorted into metal scrap (ferrous and non-ferrous) and residue (which is mainly plastics, rubber, glass, foam and fibres). In subsequent processes the ferrous and non-ferrous metals are extracted. At Fletcher Challenge's Pacific Steel the ferrous scrap metal is melted and recycled into new steel products such as steel reinforcing, nails, wire and fencing products. The non-ferrous metal is either sold locally for re-smelting or exported to South East Asia (for further recycling). The residue (containing plastics etc) are normally consigned to the landfill.

Of course, the car body is only part of the car that requires disposal. If other parts in the car are in bad condition and cannot be sold as second-hand parts, then they too need to be recycled or disposed of - this can include tyres, batteries, air conditioning units and engine fluids.



"Newell" car and steel shredder

A crane unloading steelscrap in the Auckland yard.

Source: Photographs courtesy of Sims Pacific Metals Limited.

Used tyre disposal

A number of materials are used to make a tyre - raw materials include natural and synthetic rubber, nylon or polyester cord, carbon black, sulphur, oils and resins, and chemicals. These materials form various parts of the tyre which is finally cured in a mould. As the vulcanisation during curing is essentially irreversible, it is virtually impossible for a tyre to be broken down to its original raw materials. Theoretically, the raw materials of a tyre can be recovered using intense heat (pyrolysis), but, due to the high cost, this process is very rarely used. (Goodyear Australia)

There are a number of recycling, reusing and recovery options for tyres:

Retreading - A tyre casing in good condition can have new tread added. This is basically the re-use of a tyre rather than tyre recycling, and ultimately only delays tyre disposal.

Crumbing - Tyres are shredded and the rubber granulated for use in other products such as sports surfaces, drainage materials, paints, retaining walls and asphalt for roads.

Pyrolysis - Heating tyres without air so the gas, oil and carbon can be reprocessed.

Incineration - Tyres are burnt to extract their energy value (for example, tyre-derived fuels can be used in cement kilns, pulp and paper mills and industrial boilers).
(The Consortium for Automotive Recycling-CARE)

Information on tyre disposal in New Zealand is very limited. Currently a very small number of old tyres are utilised as erosion control barriers, roadway barriers, tree guards, silage covers and in playgrounds. However, the majority of New Zealand tyres that can no longer be retreaded go to landfill.

One company looking into ways of reusing tyres can be found in Auckland. J & J Laughton Shredding Services Ltd established a tyre shredding operation in March 1997. At present the company is shredding approximately 30,000 tyres a month (approximately 360,000 tyres per year) from the Auckland region. In the future the company aims to shred at least 500,000 tyres per year. Once the company reaches the 500,000 tyres for shredding threshold, additional machinery will be acquired so that the shredded tyres can be reused to produce new products.

J & J Laughton Shredding Services Ltd estimate that between 2.5 and 3 million tyres are scrapped each year, with the Auckland region alone accounting for 1.2 million. At present most of these tyres seem to be going straight to the landfill unshredded.

What are the tyre companies doing? A Firestone tyre outlet confirmed that tyres beyond retreading condition did go to the landfill. However, Goodyear Tyreline maintains that tyres are either retreaded or go to the retread factory where they take some rubber off the old tyre to help in the new tyre process - the remainder of the tyre then goes to the landfill.

Unfortunately there is no official record of the number of tyres going to landfill. Tyre disposal is a big issue in a number of countries. Tyres stockpiled in large quantities not only pose a fire risk, but can also create an ideal breeding ground for insects such as mosquitoes. In 1993 New Zealand experienced a biosecurity scare when Asian Tiger mosquitoes were detected in a consignment of imported used tyres. (The Asian Tiger mosquito, a potential carrier of tropical diseases such as dengue fever, poses a health threat.)

In other countries tyre recycling and/or shredding is greatly encouraged. In some Australian states legislation dictates that tyres must be finely shredded before going to landfill and in some American states a disposal fee is added to the cost of a new tyre, which helps fund tyre collection and recycling depots.

Car batteries

Lead-acid vehicle batteries contain approximately 7 to 9 kilograms of lead per battery and about 4.5 to 9 litres of sulphuric acid. Lead-acid batteries are mostly used in New Zealand cars and can be hazardous to both humans and the environment.

Other types of batteries may contain lead, cadmium, mercury, copper, zinc, manganese, nickel and lithium.

Potential problems or hazards posed by batteries include:

- Pollution of waterways (such as lakes and streams) as the metals vaporise into the air when burned.
- Contributing to heavy metals that leach from solid waste landfills.
- Exposing the environment (air, land and water) to lead and sulphuric acid.
- Containing strong acids that are corrosive.
- Health problems - such as acid burns and long-term exposure to lead which contributes to nervous disorders and can impair intellectual development and learning among children.

(Nebfacts: Nebraska State Recycling Association)

In New Zealand, once a battery has reached the end of its useful life, it can be recycled. GNB Technologies, Wellington, is the only lead-acid battery recycling plant in New Zealand (the plant is capable of recycling lead-acid electric car batteries too).

According to a spokesperson from GNB Technologies, the average life of a lead-acid battery is about 3.5 to 4 years. However, this can vary greatly from anything between three months to ten years - depending on the use, the size of the car and efficiency of the car system. It is estimated that approximately 650,000 batteries are sold per year in New Zealand, and that approximately 600,000 batteries per year are recycled by GNB Technologies (GNB also recycles some batteries from their Australian branch, however, most Australian batteries are recycled by two lead smelters in Australia). Grant Bolitho, the Recycling Manager of GNB Technologies, estimated that GNB recycles approximately 85 to 90 percent of all old batteries in New Zealand.

Briefly, the processes of battery recycling are as follows: the acid is drained out and neutralised to produce water and sludge. The sludge is further treated, so that impurities can be removed.

The plastic casing is crushed into plastic chips and forwarded to Adelaide - where it is recycled into new plastic battery casings. The lead and lead oxides from the battery are refined in a furnace to produce lead (of varying grades) and slag. The slag is further treated so that it is not hazardous and meets all environmental standards, and then dumped into the landfill. This process is carried out in a controlled environment so that emissions from the plant are within regulatory limits (waste water is treated and air is filtered before being released).

Car air conditioning units

The main environmental problem associated with the disposal or maintenance of air conditioning units, is the risk of chlorofluorocarbon (CFC) refrigerant leaking into the atmosphere. CFCs have contributed to both the greenhouse gas and stratospheric ozone depletion problems. According to a Ministry for the Environment spokesperson, an air conditioning unit in good order contains approximately 800-1,200 grams of refrigerant. Up until late 1993, new cars manufactured in Japan contained air conditioning units that used CFC refrigerants, which are extremely harmful to the ozone layer. Post-1994 Japanese car manufacturers switched to using HFC-134a (a non-ozone-depleting substance). Thus it is safe to assume that cars manufactured from 1994 have air conditioning units that are ozone-safe.

Ideally before a car is scrapped, it should be taken to a reputable decommissioning company, so that the refrigerant can be collected and recovered (and reused). However, often by the time a car reaches the wreckers the refrigerant charge in the air conditioning unit is lost, leaked into the atmosphere. If the air conditioning unit is still in good condition when the car is dismantled, then it will probably be sold on by the wrecker.

The Ozone Layer Protection Company conducts a refrigeration reclaim scheme in New Zealand (there are roughly four collection points nationally, although other agents may accept on behalf of the company). Refrigerants delivered to this company are disposed of safely at no cost to the customer.

Motor fluids

Although motor fluids are changed a number of times, at the end of the vehicle's life motor fluids, such as engine oils, brake fluid, antifreeze and other lubricating oils may potentially leak out - polluting the ground and possibly the water table.

To minimise the potential hazards relating to leaking vehicle fluid, all vehicle fluids should be drained from the vehicle before the disposal process has begun. The depollution of all vehicle fluids is important for several reasons:

- A vehicle standing in a dismantler's yard awaiting parts removal has the potential to leak fluid, especially if the vehicle is damaged.
- When a vehicle is crushed or shredded the residual material could act as a medium and transfer pollutants to the ground.
- There is an opportunity to recycle/re-use the used fluids.

(The Consortium for Automotive Recycling - CARE)

In New Zealand the Oil Recovery Group has developed a programme which aims to extract further value from used oil and to minimise risks to health and the environment. The nation wide programme enables used oils to be collected and used as fuel in high temperature cement kilns. The Oil Recovery Group is made up of the major oil companies (eg BP, Castrol, Shell and Caltex), and Milburn New Zealand Ltd. The programme aims to recover 95 percent of New Zealand's recoverable used oil by the year 2000.
(New Zealand Auto Industry Fact File, 1997)

Plastics

In the shredding of a car body, plastic is generally destined for the landfill. It is estimated that around 10 percent of a vehicle's weight is made up of plastic. Potentially these plastics can be recycled, although a number of problems need to be overcome.

Within a car, a number of different plastics are used - for example, the Vehicle Recycling Development Centre in the United States discovered as many as 15 types of plastics in instrument panels alone. It is estimated that there could be more than 25 types of plastic used in a complete car. Because a vehicle can have a number of different kinds of plastic (each plastic having a specific chemical make-up), segregation for the purpose of recovery is a challenge. The process of sorting plastic components

is complicated by the use of a variety of bonding methods - from moulding to glueing (especially in the assembly of a vehicle instrument panel). Apart from the segregation issue, there is the additional problem of metal clips, screws, labels, foam etc contaminating the recoverable plastic components.

Major car manufacturers are now looking at the issue of plastic recovery, with particular regard to design changes and types of plastics used, so that plastics can be easily segregated, identified and recycled.

Materials that can be potentially recovered include:

- Polyester - material from which seat belts are made.
- ABS - a hard plastic typically used for interior trim components such as steering column covers and centre consoles.
- Polypropylene - a softer plastic found in the construction of the majority of plastic bumpers, engine components and some interior trim mouldings.

(The Consortium for Automotive Recycling - CARE)

Overseas developments - the way of the future?

In the United States and United Kingdom, groups of car manufacturers, dismantlers and environmental agencies are devoted to vehicle recycling. The individual organisations are working together to reduce the amount of waste going to landfills.

An example of one of these groups is USCAR - United States Council for Automotive Research - which manages the Vehicle Recycling Development Center (VRDC). VRDC comprises Chrysler Corp., Ford Motor Corp., General Motors Corp., the Automotive Recyclers Association, the American Plastics Council and the Institute for Scrap Recycling Industries. The goals of the vehicle recycling partnership are to:

- Reduce the total environmental impact of vehicle disposal.
- Increase efficiency of the disassembly of components and materials to enhance vehicle recyclability.
- Develop material selection and design guidelines.
- Promote socially responsible and economically achievable solutions to vehicle disposal.

(USCAR-Technology in Action web page)

Ninety-five percent of the vehicles scrapped in the United States are collected for reuse and recycling. Approximately 10 million vehicles are recycled annually, and about 75 percent of the material by weight from those vehicles is recycled.

In the United Kingdom, the Consortium for Automotive Recycling (CARE) is a collaborative project of vehicle manufacturers and vehicle dismantlers. CARE's main aim is to reduce the amount of vehicle weight going to landfill (at present 25 percent of the vehicle weight goes to the landfill - mainly made up of non-metallic materials such as plastic, rubber and glass). Other priorities include more efficient (and environmentally friendly) vehicle fluid collection, and to increase the usage of recycled materials.

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Acknowledgements

I would like to acknowledge the contribution of all those people who helped in the preparation of this article, especially GNB Technologies, the Ministry for the Environment, Sims Pacific Metals Ltd and J & J Laughton Shredding Services Ltd. Mention must also be made of the Dunedin City Council who provided the cover photographs.