

GREENPEACE

**OFFROAD CARS,
ONROAD MENACE
4X4s IN THE CITY**



THE SUITABILITY OF OFFROAD VEHICLES
FOR URBAN ENVIRONMENTS

was written by:

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FOREWORD

The so-called Sports Utility Vehicle (SUV), better known in the UK as the 4x4, has become a common sight in our city centres. As sales of these oversize family run-arounds continue to increase, concern is escalating over their impact on the climate and the danger they pose to pedestrians and other road users.

While the urban SUV driver might be irresponsible, the real villains are the car manufacturers who market ever bigger, heavier, and more polluting cars. This report, by a respected academic from one of the country's top automotive industry economics centres, outlines how and why car manufacturers design and promote cars that are inefficient and so totally unsuited to the urban environment in which they are predominantly used. It details how vehicles designed for offroad terrain consume **300% more fuel**, emit **300% more pollution** and, in an accident, are **three times more likely to kill a pedestrian** than an ordinary passenger car. They are also twice as likely to cause severe traumatic brain and abdominal injuries and 50% more likely to kill the passenger of another vehicle.

The immense threat posed by climate change has now been recognised by governments across the world. Power generators and other industrial sectors are being forced to make reductions in carbon dioxide emissions. Not so the transport sector. Car manufacturers, under pressure to do something about their rapidly increasing contribution to climate change, agreed to voluntarily reduce CO₂ emissions from an average new car to 140g/km by 2008. This is not a demanding objective considering that family saloons like the Toyota Prius and new Honda Civic hybrid already emit less than 110g/km. But it is now clear that car manufacturers will fail to keep this promise: EU-wide average emissions are still in the mid-160s and those of new vehicles in the UK are even higher. Land Rover's American boss Bill Ford says, 'climate change... warrants precautionary, prudent and early actions', yet Land Rover's 4.4V8 Range Rover emits a staggering 389g/km. This report examines the impacts of the growing use of 4x4s in the urban environment by examining in detail the characteristics of the Land Rover Discovery and Range Rover models.

There is now an overwhelming consensus on the need for urgent action to avert the most severe impacts of climate change. In the light of the suffering climate change is already causing, I have no hesitation in calling the design and promotion of vehicles that pump out such excessive amounts of greenhouse pollution, criminally irresponsible. This report presents the evidence to back up that statement.



Stephen Tindale, Executive Director, Greenpeace UK

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THE SUITABILITY OF OFFROAD VEHICLES FOR URBAN ENVIRONMENTS: AN EXAMINATION OF THE LAND ROVER DISCOVERY AND RANGE ROVER MODELS

A. PRELIMINARY OBSERVATIONS

(I) DEFINITION OF TERMS

1. There are various terms used somewhat interchangeably to refer to the type of vehicles represented by the two Land Rover models in question. These terms are not defined by legal requirements arising from vehicle test and registration legislation, but are used by the automotive industry and in popular discourse to describe the vehicles and to place them within so-called 'segments' of the overall market. This can result in ambiguity and confusion when the vehicles are discussed, either as a general class or as (in this case) representative of a class. The main terms in common usage are:

- **4x4**
- **Sports Utility Vehicle (SUV)**
- **Offroad vehicle**

2. A **4x4 vehicle** is one that has (usually permanent) four-wheel drive. The majority of saloon cars, hatchbacks and other passenger cars sold in the UK are front-wheel drive only. Some are rear-wheel drive (BMW models for example). Four-wheel drive vehicles are not necessarily endowed with specific offroad capability by design, and some vehicle manufacturers have introduced four-wheel drive versions of models that are more commonly found as front-wheel drive: Audi for example has four-wheel drive variants of their A3, A4, A6 and A8 models, sold with the Quattro designation. Subaru specialise in four-wheel drive models, only one of which could be described as being near the same market segment as the Land Rover Discovery or Range Rover. Sometimes the term 'all-wheel drive' is used. Generally speaking, the Land Rover models in question can be considered as large 4x4s, whereas the Land Rover Freelander model is an example of a medium 4x4.

3. A **Sports Utility Vehicle** is a description 'imported' from the US market, and one that has given rise to several variants of terminology along the lines of Sports Activity Vehicle, Multi-Activity Vehicle, etc. The term does not describe a sports car at all, but rather conveys the idea that the vehicles in question have a range of capabilities that cross between work (utility) and leisure (sport). In the US context, this designation therefore also conveys the idea that the vehicles might be used as functional

tools to enable certain work tasks to be carried out – indeed this is the origin of the distinction in US legislation between the passenger car segment and the 'light truck' segment. This is a somewhat confusing term because while the SUV segment does indeed capture the Land Rover Discovery and Range Rover, it is also used to embrace a wide range of vehicles that are distinctly different in terms of engineering, design and functional capability. For example, the Toyota RAV4 and Honda CR-V are both SUVs under this definition – albeit rather smaller than the Land Rover models.

It is worth noting, however, that the Land Rover models are classed as light trucks in the US market. As an example, one industry journal in Europe (Automotive News Europe) defines four classes of SUV: small (no Land Rover example); medium (Defender; Freelander); Large (Discovery); and Premium (Range Rover). It is worth noting that the Land Rover Defender is classed as a commercial vehicle by the UK industry body the SMMT, in recognition that this particular model is largely used as a functional tool. The Land Rover Discovery and Range Rover are classed as cars.

'It is important to recognise that while a vehicle might be described as 'best in its class', such a description could also mean 'best of a bad bunch''

4. The term **offroad vehicle** is used to describe a vehicle that has, to some degree, the capability to be used off road. It does not mean that the vehicles are confined to offroad applications in the way that, for example, some very heavy-duty quarry lorries are so confined. The extent to which vehicles are able to go offroad is not precisely defined, and again a wide variety of vehicles may fall into this category. For example, quad-bikes are light-weight, single-seat offroad vehicles used both in work and leisure applications. As discussed below, designing a vehicle to be capable of offroad performance carries a significant efficiency and safety penalty when it is used on normal roads.

(II) MODEL COMPARISONS AND THE MODEL CYCLE

5. The Land Rover Discovery and Range Rover are both relatively recent introductions. Equally, the engines employed in the models, both diesel and petrol, are of recent design arising from the ability of Land Rover to be supplied with the engines from within the Ford group. This means that there should be a reasonable expectation that their performance, when compared with other models of a similar type or indeed with the new car population in general, should be favourable. Clearly, this is a dynamic situation. Old models are removed from the market, and new models are introduced. In the UK market, recent introductions to the segment in which the Land Rover Discovery and Range Rover could be said to be active include the new Mercedes M Class and the Lexus RX400h.
 16. It is also important to recognise that while a certain vehicle might be described as 'best in its class' for whatever reason, such a description could also mean 'best of a bad bunch'. Moreover, comparisons with vehicles outside the same segment may be misleading if only certain parameters are included. For example, it might be said that some Multi-Purpose Vehicles (MPVs, exemplified by the Renault Espace) may be longer than certain SUVs, but carry the same number of people. This indeed may be true, but it might also be the case that the MPV has a better performance in terms of pedestrian impacts. In general terms, it is usually the case that a specific model is not uniformly or comprehensively better than other models across all criteria. In any case, the ultimate valid comparison is in terms of functional ability to move one or more people on normal roads in the most sustainable or socially responsible manner. At issue here is the inappropriate promotion of vehicles for urban use.
- ## (III) COMPARISONS WITH THE US
7. Much of the debate about the suitability of large 4x4 vehicles like the Land Rover Discovery and Range Rover for urban environments has derived from the situation in the US. In the US market approximately half of all vehicle sales (other than commercial vehicles) are in the light truck segment, following several years of steady growth in market share. This broad segment includes a range of vehicle types, with pick-up trucks a significant element. In broad terms, the concerns raised in the US can be said to have arisen because the relatively high proportion of light truck sales of all types has brought an awareness of the social and environmental problems occasioned by the widespread use of such vehicles as if they were passenger cars in situations where the vehicles are inappropriate.
 8. Clearly, there are differences between the US market and the UK. As is discussed later in this report, such differences need not mean that the US experience is inapplicable to the UK. Rather, it means that some care should be taken in understanding the US data. The high level of public concern in the US, reflected in for example the coverage given in the New York Daily News, is itself indicative of a problem, with some reports attributing one in five of pedestrian deaths to SUVs in New York (Buettner and Lisberg, 2005).

'The assumption is that consumers should be able to purchase whatever vehicle they wish, regardless of the wider social and environmental costs'
 9. Similarly, it is important to recognise that the UK has a very good road safety record overall compared with other countries, but that an issue such as road safety is one that has multiple causal factors including driver attitudes and the prevailing culture of car use, road design, enforcement, vehicle design, and the capabilities of the emergency services. While the UK record is comparatively good, there are still thousands killed or seriously injured, whether drivers, passengers, pedestrians or cyclists. It is therefore important to identify and if possible eradicate the causes of those deaths and injuries, including issues of vehicle design. The vehicle manufacturers, as custodians of engineering knowledge, have a responsibility to design and sell vehicles appropriate to the circumstances.
 10. Consumers are only able to make choices based on the products offered by the vehicle manufacturers, so demand as such is not necessarily a guide to the choices that consumers would make in an ideal world. That is, just because a vehicle sells in large numbers does not mean that it is a 'good' product per se, either in relative or absolute terms.
 11. Consumers are also likely to seek to maximise their personal utility first, and be rather less concerned about the wider social costs. In this respect, the purchase of a large or heavy vehicle might (or might not) be logical as a means of maximising personal safety, even if it also potentially reduces the safety of other road users. In broad terms, the assumption is that consumers should be able to purchase and use whatever vehicle they wish from those available on the market, regardless of the wider social and environmental costs (negative externalities) because these are matters handled by the government and by companies. In the contemporary era it is widely

accepted that companies have a 'corporate social responsibility' towards society and to the environment by virtue of the concentration of knowledge and resources the companies enjoy. This responsibility can and should involve more than mere compliance with regulatory controls and legal standards, but should also involve active leadership, enacting changes ahead of any such controls and standards, and using those resources to arrive at innovative solutions to social and environmental problems.

B. THE SUITABILITY OF THE LAND ROVER DISCOVERY AND RANGE ROVER MODELS FOR URBAN USE

12. This section of the report considers in general design and engineering terms the suitability of the Discovery and Range Rover models for urban use. Detailed comments with respect to the fuel efficiency and safety performance of these vehicles follow in the later sections.
13. Historically, the market for such large 4x4 vehicles has been constrained by the engineering choices required by the vehicles to meet the requirements of offroad performance, which resulted in relatively slow, noisy, crude and cumbersome vehicles when applied to everyday on-road use. Further, these vehicles tended to be characterised by the lack of features considered usual for a mainstream car, with resultant lower levels of comfort.

'The basic design of the Discovery and Range Rover results in vehicles that are heavier and therefore result in a higher fuel consumption and CO₂ emissions

14. More recently, vehicle manufacturers have sought to combine the offroad characteristics and capabilities with those expected of mainstream cars, thereby broadening market appeal. In so doing, as with any engineering compromise, some degree of traditional utility may be lost. The application of contemporary electronic control systems, combined with engineering features in the vehicles, has however enabled some of the features that were least acceptable to drivers and passengers of large 4x4 vehicles (such as excessive body roll) to be reduced to tolerable levels.
15. The basic design of the Discovery and Range Rover models remains premised on offroad performance. The vehicles feature a separate steel chassis (essentially a ladder frame) that provides a very stiff platform for the suspension system and allows better ground clearance and suspension articulation than would be obtained with the unitary steel body employed for mainstream road cars. The separate chassis and attached body structure are therefore integral to the design philosophy and form the basis for the offroad performance of the vehicles. In general terms, such a design approach also results in vehicles that are heavier than would be the case with a unitary design (which is one reason why the unitary

design is used for the vast majority of cars). Inevitably, all other aspects being equal, this design philosophy therefore results in higher fuel consumption and CO₂ emissions than would be the case with a unitary body design. It is difficult to quantify the exact fuel economy burden of such a design feature.

16. The sheer size of the models in question, arising from the specification of the vehicles as having the ability to take several people and/or equipment offroad into quite challenging terrain, results in vehicles that are simply heavy. There is in effect a weight-gain spiral in which other components (brakes, suspension, etc.) have to be made heavier to cope with the extra loads. In turn this requires a larger engine, delivering more power, and hence a larger transmission system. The Land Rover Discovery TDV6 has a kerb weight of 2,720 kg despite the use of aluminium and high-strength steel in the body structure.
17. The use of four-wheel drive also adds weight to the vehicle, which in addition to increasing friction losses in the drivetrain increases fuel consumption. The use of large wheels and tyres, also features required for offroad performance, further adds weight and decreases the aerodynamic efficiency of the design by increasing the frontal area of the vehicle. The models also feature low-ratio transmissions that are only required in severe offroad conditions. These features too are therefore fundamental to the design of the vehicle for offroad performance, but contribute to relative inefficiency when used on roads. It is evident that four-wheel drive is not necessary for normal urban use, or indeed for normal road driving. The cars that are generally recognised as the best 'drivers' cars available, that is the BMW 3 Series and 5 Series, feature rear-wheel drive. The vast majority of other cars are front-wheel drive.
18. As a guide, it is a reasonable view that a 10% reduction in weight can yield a 5-6% improvement in fuel economy.
19. Vehicle weight is the primary determinant of fuel economy at lower speeds, all other things being equal. Those lower speeds, particularly accelerating from rest, are most likely to be found in congested urban environments. Vehicle weight is also a factor in the effect of an impact with other vehicles, notably heavier vehicles will have a greater impact on lighter vehicles.
20. The square and robust styling of the models, that derives from earlier applications of 4x4 vehicles such as the Land Rover Defender and has become a clear design motif for the brand, results in a large frontal area (including the tyres) that further reduces fuel economy at higher speeds. This styling, combined with the clearance of the vehicle

that derives from the offroad performance requirement, also has a deleterious influence on the safety performance of the vehicle, particularly with respect to the impacts with pedestrians. High clearance is not required for normal urban use, and may be argued to encourage irresponsible driving such as mounting kerbs when parking. High clearance is more likely to result in instability at speed, and contributes to the high centre of gravity in typical 4x4 vehicle that in turn results in a greater tendency to roll over in certain accidents. Again, the high clearance of these vehicles is a direct consequence of the design of the large 4x4/SUV class to enable them to travel over rocky or rutted ground.

'The Discovery and Range Rover models have several features that are functionally useless in normal urban driving'

21. The Discovery and Range Rover models both therefore have several features that are functionally useless in normal urban driving. Their presence on the vehicle adds complexity and cost, and also weight. Moreover, these features represent an opportunity cost in that for a given product development budget the resources spent on their deployment could have been directed elsewhere in a manner that would ameliorate some of the fuel economy and other concerns with the vehicles.
22. The Terrain Response feature is an automated system that adjusts the performance of the vehicle according to the conditions encountered. Thus, this feature can adjust to sand, mud and ruts, snow/grass/gravel, and rutted rocky terrain. Of these, only snow is found in London, on average for about 5 days per year (i.e. less than 2% of the time) and rarely more than a light covering. There are no sand dunes in London. There are no glaciers in London. There are no rivers that require to be forded, there are no scree slopes, there are no mountains, and there is no mud apart from the occasional path in Highgate woods. The UK has a mild climate and a good road network, so there is no need for the performance characteristics of the Range Rover or Discovery models.
23. It is because of the poor safety and fuel economy performance record of these vehicles, a record that derives directly from the design of large 4x4/SUVs, that encouraging and allowing them to be sold and used in urban environments is irresponsible.

C. SAFETY AND THE LAND ROVER DISCOVERY AND RANGE ROVER MODELS

24. Deaths and injuries from road accidents are a serious issue for public health. At the global level, the World Health Organisation (WHO) recently issued a report that highlighted the human and economic cost of such deaths and injuries (WHO, 2004). The report recognised that the issue was one involving multiple factors and agencies. One important factor was, however, vehicle design and hence one important agency was the vehicle manufacturers that design and manufacture those vehicles (Pless, 2004).

25. While much has been made of the relatively good safety record in the UK, and while the vehicle manufacturers should get due recognition for the introduction of technologies and features to improve safety in the event of an accident, recent research has shown that a significant proportion of the improvement is attributable to better rescue and recovery systems operated by the emergency services (Dobson, 2003).

26. In 2003, according to data from the UK Department for Transport, there were 3,508 people killed in road traffic accidents in the UK, 33,707 serious injuries, and 253,392 slight injuries. Of these there were 114 pedal cyclists killed, and 774 pedestrians killed with 7,159 seriously injured. That is, 22% of deaths from road traffic accidents were pedestrians in 2003. In 2004 there were 3221 deaths, of which 671 were pedestrians.

'With respect to impacts with other vehicles, the main issues are the relative weight of the 4x4/SUV and the incompatibility of these vehicles with the impact structures found on cars'

27. In order to gain Type Approval for sale in the European Union all models must meet specified safety standards. These standards, however, pertain to the safety of the occupants. On the 1st October 2005 the first EU pedestrian impact safety standards were introduced for all new models entering the market from that date. Standards such as these can be seen as minimum entry requirements. Indeed, the desire to encourage vehicle manufacturers to do more than meet the standard lay behind the establishment of the EuroNCAP scheme, paid for and conducted by several EU Member States. Safety standards, as with emissions standards, are also a pragmatic definition based upon a compromise between

the ideal, and that which can be obtained within a reasonable time and cost, and in view of available information. Light trucks in the US market do not have to meet crash standards.

28. There are two areas of concern with respect to the safety performance of the Land Rover Discovery and Range Rover models. These are impacts with other vehicles, notably smaller and lighter cars, and impacts with pedestrians. Of course, in a congested urban environment other sorts of impact are possible, with people on bicycles, in wheelchairs, or in prams for example. However these have not been subject to systematic study.

29. Evidence from the US can be a useful starting point to understanding the relative safety performance of large 4x4 vehicles. In particular, US data gives an insight into the consequences when a large 4x4 is in collision with a car.

30. It is accurate to say that the US light truck segment upon which this data is based reflects a situation somewhat different to the UK. In the US market this segment includes the 4x4/SUVs of the type represented by the Land Rover Discovery and Range Rover models but also includes MPVs, pick-up trucks (i.e. with a cab and a flat load bed behind), and various sorts of light commercial vehicle. It is also the case that these vehicles are often heavier and bigger than many of the 4x4/SUV vehicles currently on sale in the UK. Moreover, the extent to which drivers and passengers wear seatbelts, although rising, is lower than in the UK. On the other hand, these factors may be offset by other considerations, notably:

- US cars are also larger and heavier on average. There is of course a 'sub-compact' segment of the market, but no representation of European 'super-mini' cars (e.g. Peugeot 206) or city cars (e.g. Smart ForTwo).
- US legal road speed limits are often lower than those in Europe or the UK, particularly in urban areas.
- US legal requirements at junctions are also different, for example with the 'four-way stop' at crossroad junctions in urban areas.
- US driving styles (or automobility culture) tend to be more relaxed and slower, aided by the almost ubiquitous use of automatic transmission and power steering.

31. With respect to impacts with other vehicles, the main issues are the relative weight of the 4x4/SUV and the incompatibility of these vehicles with the impact structures found on cars. The greater weight means that

for a given speed there is more energy to transfer to the other vehicle. The greater height of the 4x4 means that the point of impact tends to be higher than the bumpers or side-impact beams of the car, thereby allowing greater intrusion into the car or even riding up over the car. The stiffness of the SUV chassis means that it does not absorb the impact energy through progressive deformation, which is the way in which cars manage impacts via 'crumple zones', rather the chassis becomes the means by which energy is transferred to the other vehicle.

32. With these considerations in mind, the available US data clearly support the view that 4x4/SUV vehicles are more dangerous to other road users than traditional cars in the event of an accident.

33. One comprehensive source of data is the US Insurance Institute. In a report in the Wall Street Journal in 2005, citing research from the Insurance Institute, the question

'In the heaviest SUVs the death rates were nine times higher for car occupants compared with SUV occupants'

of compatibility between dissimilar vehicles was examined in detail. The study did show that over time the performance of all vehicles has improved, a feature ascribed to greater use of airbags and seatbelts.

However, the study also looked at two-vehicle crashes between SUVs and passenger cars. It concluded that death rates were 59% higher for occupants of passenger cars compared with occupants in the lightest SUVs. In the heaviest SUVs the death rates were nine times higher for car occupants compared with SUV occupants. It is notable that the Land Rover Discovery and Range Rover models are indeed large vehicles.

34. The Insurance Institute for Highway Safety (IIHS) undertakes tests of vehicles. In one series of tests, it examined what happened to small cars when struck from the side by an SUV. The report said:

'The Institute's test is more challenging because the top of the barrier (simulating the SUV) is at the same level as the heads of the dummies in the car...This is the scenario in real-world side impact crashes where occupants heads are often struck by the intruding hood of an SUV.'
(IIHS, 2004)

35. In tests reported in 2005, the IIHS showed that 14 out of 16 small cars rated poor, none of the 16 rated good although side head and body airbags would have helped,

as would stronger structures in the small cars (IIHS, 2005).

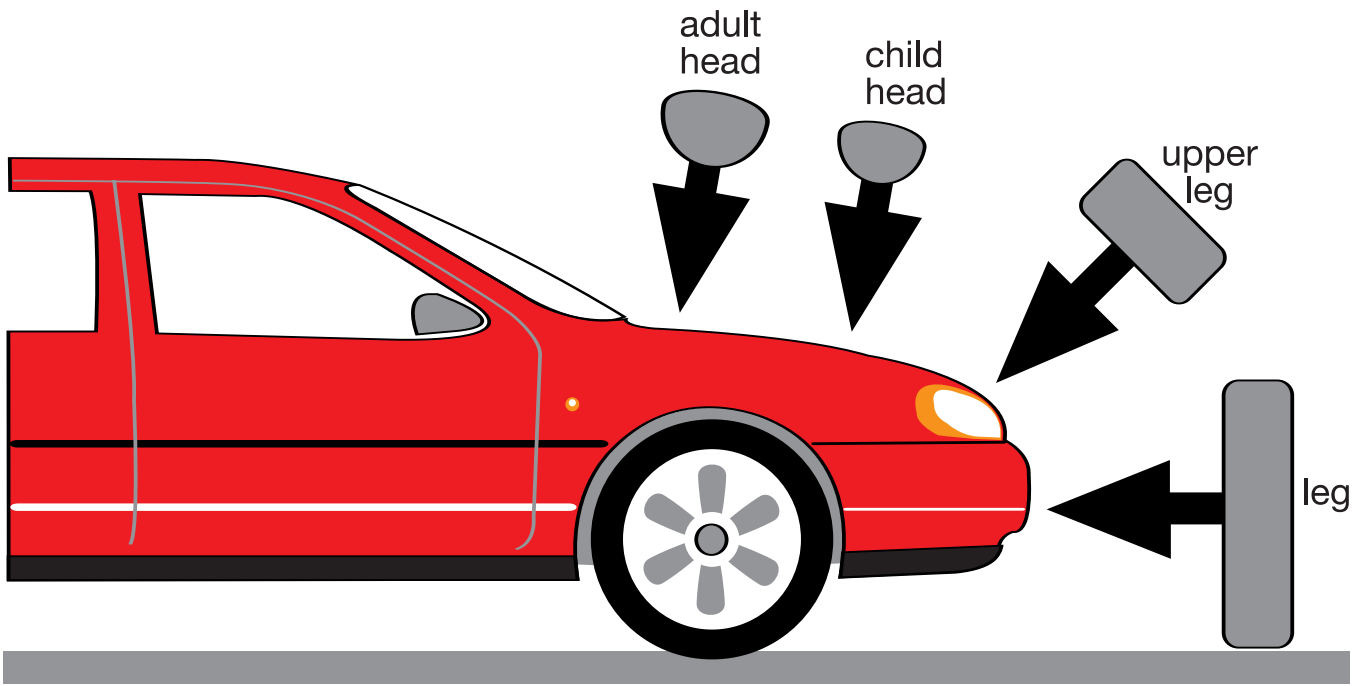
36. With respect to deaths and injuries caused to pedestrians, the implications for 4x4 vehicles are somewhat different. In general, the fact that these vehicles tend to be heavier than the average car is of reduced consequence because the mass differences compared to the average person are in any case already large. Of more consequence is the design of the front of the vehicle and the way in which pedestrian impacts are 'managed' by the vehicle.

37. In the case of a normal front-engine car of typical height the point of impact with the pedestrian is the bumper, which usually hits on the legs between the knee and the thigh. This primary impact then causes the pedestrian to rotate over the front of the car and results in secondary impacts, with the bonnet, windscreen frame or windscreen, to the head and upper body. The secondary impacts are more likely to result in death or serious injury. Further injury may be caused upon impact with the ground or other objects. Vehicle design improvements to reduce death and serious injury have concentrated removing prominent features on the front of the car that could cause damage, and on managing the energy of the secondary impact. Such features can mitigate the effect of the impact on the pedestrian. Other concepts, such as external airbags, have been explored but not so far used.

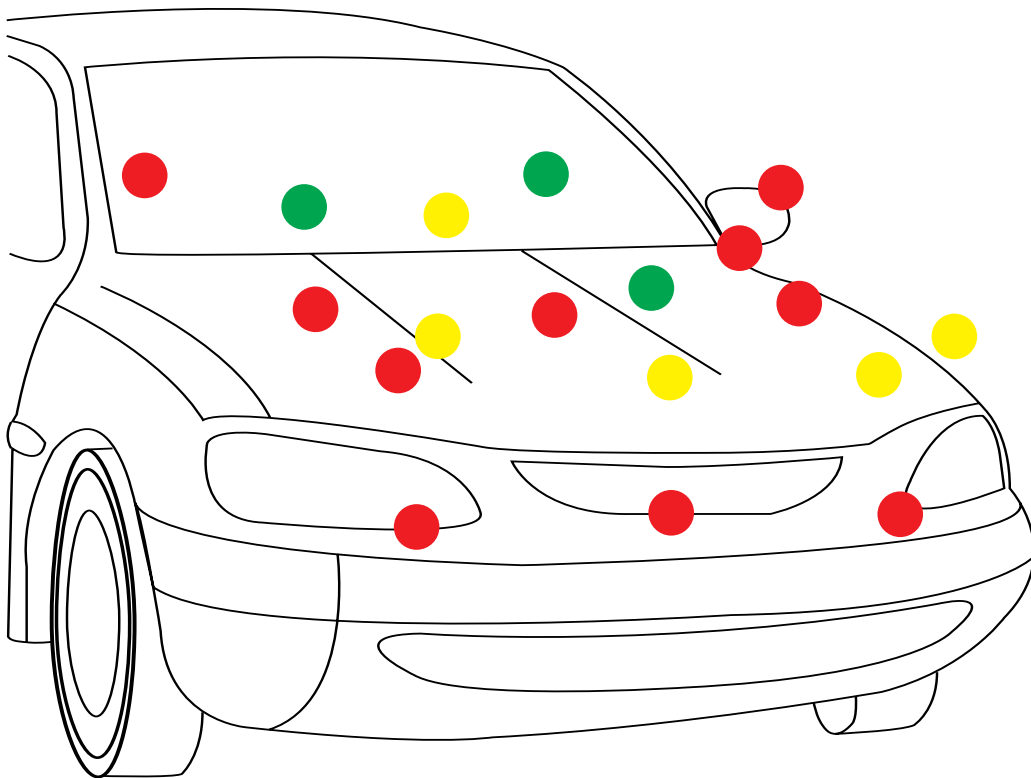
38. With a typical 4x4 vehicle as exemplified by the Land Rover Discovery and Range Rover models, the front of the vehicle is higher off the ground, and presents a 'wall' of steel, plastic and glass to the pedestrian. This has two consequences. First, the point of impact is higher, and more likely to be in the much more vulnerable torso region of the pedestrian. Second, the pedestrian cannot rotate over and onto the bonnet so there is a reduced opportunity to manage the impact forces. The photograph below shows the front end of the Land Rover Discovery, and illustrates the wall that might confront a pedestrian.



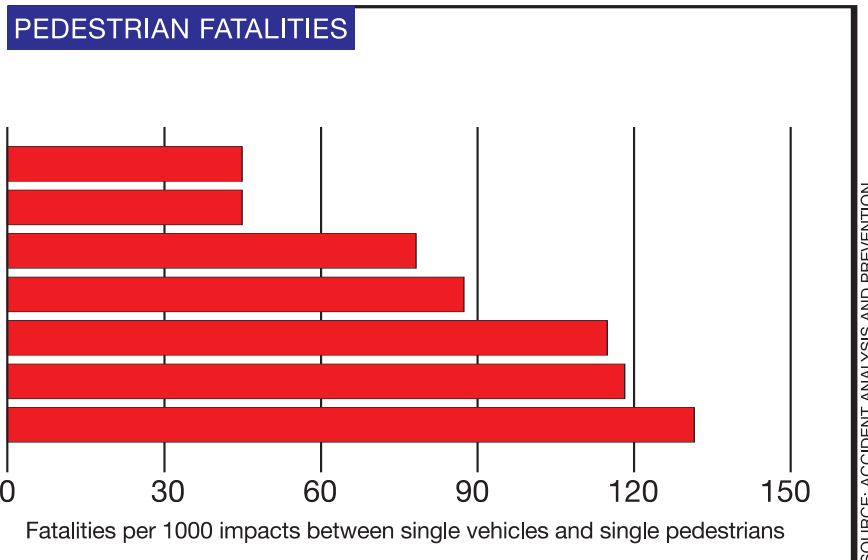
The 'wall' that confronts a pedestrian (Source: Land Rover)



Typical impact pattern for a pedestrian and a standard passenger car (After: EuroNCAP)



Typical impact points for a pedestrian and a standard passenger car. (After: EuroNCAP)



Pedestrian fatalities per 1000 impacts (After: New Scientist, 12 December 2003)

39. A recently published study (Roudsari et al, 2004) of research undertaken by the Harborview Injury Prevention and Research Center, Seattle, and the Center for Applied Biometrics, University of Virginia, based on 542 cases in the Pedestrian Crash Data Study (1994 to 1998) concluded that pedestrians struck by Light Trucks and Vans (LTVs) had a higher risk of injury and death. After allowing for the age of pedestrians and the speed of the vehicles, the study concluded that pedestrians had a 3.4 times higher risk of death when struck by LTVs compared with passenger cars. The study drew attention to the front-end design of vehicles was a particular area of concern. Other US research has tended to support the overall theme that compared with passenger cars, SUVs, pick-ups and vans are more dangerous for pedestrians (Starnes and Longthorne, 2003).

40. A similar study (Lefler and Gabler, 2004) using the Pedestrian Crash Data Study along with the Fatality Analysis Reporting System, found that pedestrians were two to three times more likely to die when struck by an LTV compared with a passenger car and that for a given impact speed the likelihood of serious head and thoracic injury is 'substantially' greater when struck by an LTV rather than by a passenger car.

41. Research using a four-year data set (1995-1999) in Maryland, USA came to broadly similar conclusions (Ballesteros et al, 2004). This study used police, registry, trauma and autopsy data. Importantly, at lower speeds (i.e. within an urban context) the data showed that pedestrians were approximately two times as likely to have severe traumatic thoracic, brain and abdominal injuries when hit by SUVs, pick up trucks and vans compared with passenger cars. The study also concluded

that at slower speeds, when hit by LTVs pedestrians showed specific injury patterns 'indicating that vehicle design may contribute to different injury patterns'.

42. The diagram above, reproduced from the New Scientist online but derived from the article in Accident Analysis and Prevention, gives a graphic representation of the rate of fatalities per 1,000 impacts for pedestrians according to the type of vehicle. This data shows how a large 4x4/SUV of the type represented by the Land Rover Discovery and Range Rover are an order of magnitude more dangerous to pedestrians than passenger cars, MPVs, or even compact SUVs and pick-up trucks.

'The likelihood of serious head and thoracic injury is "substantially" greater when struck by an LTV rather than by a passenger car'

43. The EuroNCAP pedestrian impact test measures a series of points on the front of the car where impacts are to be expected, to determine how 'forgiving' those points are. The current generation Land Rover models have not been tested under the EuroNCAP process. The previous generation Land Rover Discovery was awarded just one star (out of a possible five) and described as 'dire'. The diagram above left, redrawn from the EuroNCAP website, shows the typical impact pattern for a pedestrian and a standard passenger car.

44. The diagram left illustrates a typical pattern of impact points tested and the results that might be obtained, with

different colours representing different degrees of damage caused, again using a standard passenger car.

45. The tests for EuroNCAP are undertaken at 25 mph and are based on the European Enhanced Vehicle-safety Committee (EEVC) guidelines.
46. European requirements for more stringent tests with respect to pedestrian impacts are due to for introduction in 2010, though the nature of the requirements has not yet been specified. For passenger cars, the requirements of the 2005 pedestrian impact tests are not thought by engineering experts to be particularly problematic for most vehicles. The key measures are likely to involve increasing the gap between the bonnet and the engine block (so allowing deformation under impact with the head or torso of the pedestrian), and the use of softer materials at the front of the vehicle.
47. It is worth noting that a significant number of the pedestrian casualties arise from the head impacting on the ground or another object, after the collision with the vehicle. In a normal passenger car, the measures adopted already and into the future can act to absorb some of those impact forces on the vehicle itself. It seems possible, however, that if the pedestrian is hit by a large 4x4 there is literally nowhere for them to go except to be flung at force away from the vehicle, so increasing the probability of a dangerous contact with the ground.
48. While much of the research into these issues has been done in the US, it is important to recognise that the work has been conducted by respected universities and research institutes and published in peer review scientific journals. That is, notwithstanding the high levels of public concern in the US, the research into the safety implications of SUVs arises from road traffic and medical professionals who have

‘Since the Kyoto Protocol there is a strong case for arguing that there is a clear corporate responsibility for all subsequent global warming impacts associated with CO2 emissions from vehicles’

identified a real problem. It is manifestly not the result of agitation by some vocal but misguided minority pressure groups. With the growth in the ownership and use of large 4x4/SUVs in the UK and elsewhere, those professional concerns are also being raised here. Thus, for example, a recent editorial in the British Medical Journal drew attention to the fact that the growth in large 4x4/SUV

sales, and the overall aging of the population, represented a significant potential public health problem (Simms and O’Neill, 2005). The authors argue that people over 60 are four times more likely to die if injured by a vehicle than younger people. Older people constituted 30% of pedestrian deaths compared while comprising 11% of the population. The authors conclude that ‘The proliferation of sports utility vehicles represents a backwards step in safer vehicle design.’

49. It is an abdication of responsibility to say that a) the vehicles meet the minimum tested safety standard and b) it is consumers that buy and use these vehicles in whatever manner they see fit. As has been shown in the case of hybrid vehicles being pro-actively promoted and developed by Toyota, there comes a point where the urgency of the situation absolutely demands clear leadership.

D. FUEL ECONOMY AND THE LAND ROVER DISCOVERY AND RANGE ROVER MODELS

50. The UK has been monitoring the CO₂ emissions performance average for new car sales since 1997. This emissions data is obtained from the EU test cycle (that also measures toxic emissions from the exhaust). The test cycle was somewhat revised with the introduction of the Euro 4 exhaust emissions limits, in an effort to reflect contemporary road conditions. It remains, however, a relatively gentle test cycle. It should be noted that driving at higher speeds or with rapid acceleration will deliver higher CO₂ emissions than those reported under the test cycle (see the Vehicle Certification Agency website).

51. A reading of the relevant scientific literature shows that the situation with respect to global warming is already perilous, and in danger of getting out of control as positive feedback loops develop. The urgency of this

situation cannot be overstated. Any vehicle manufacturer will be aware of this issue, and since the Kyoto Protocol there is a strong case for arguing that there is a clear corporate responsibility for all subsequent global warming impacts associated with CO₂ emissions from vehicles.

52. A key target is that of an average of 140 g/km CO₂ emissions, the figure agreed to be reached between the European automotive industry representative body (ACEA) and the European Commission by 2008.

'Poor fuel economy derives from... the consequence of trying to match offroad performance with the levels of comfort and convenience expected by those that are going to drive the vehicles in urban areas.'

Ranking	Make	Model	Engine cc	Transmission	CO ₂ (g/km)	Fuel Consumption MPG	Fuel cost of driving 12000 miles
1	Honda	Insight	995	5MT	80	83.1	525
2	Toyota	Prius	1497	E-CVT	104	65.7	664
3	Peugeot	107	998	M5	109	61.3	712
4	Toyota	Aygo	998	Multi5	109	61.4	711
5	Smart	City Coupé Hatchback	698	SM6	113	60.1	726
6	Daihatsu	Charade	989	M5	114	58.9	741
7	Vauxhall	Corsa	998	MTA	115	58.8	742
8	Smart	Roadster	698	A6	116	57.6	758
9	Honda	Civic IMA	1339	5MT	116	57.6	758
10	Daihatsu	Sirion	998	M5	118	56.5	772

The ten best petrol vehicles (Source: Vehicle Certification Agency)

Ranking	Make	Model	Engine cc	Transmission	CO ₂ (g/km)	Fuel (mpg)	Fuel cost of driving 12000 miles
1	Citroen	C2	1398	M5	107	68.9	665
2	Citroen	C3	1398	M5	109	67.3	681
3	Renault	Clio	1461	M5	110	67.3	681
4	Peugeot	206	1398	M5	113	65.6	699
5	Renault	Clio	1461	M5	113	65.8	696
6	Fiat	Panda	1248	M5	114	65.7	697
7	Ford	Fiesta	1399	M5	114	65.7	697
8	Vauxhall	Corsa	1248	MTA	115	65.6	699
9	Peugeot	1007	1398	M5	115	64.1	715
10	Smart	1493	1493	S/A6	116	64.2	714

The ten best diesel vehicles (Source: Vehicle Certification Agency)

The target figure of 140 g/km does not necessarily mean that the contribution of personal transport to global warming is reduced to levels sufficient to reverse the process, but can at least be taken as a guide to the contribution of the large 4x4/SUV segment. In 1997, the average figure for new cars sold in the UK was 189.8 g/km CO₂ emissions, falling to 172.1 g/km by 2003 (SMMT, 2004 p408). Looking at the rate of improvement in fuel economy (i.e. reduced CO₂ emissions), the SMMT annual report concluded that 'In 2003 all bar the sports and 4x4 segments bettered the overall market's pace of decline'.

53. The data given by the SMMT on CO₂ emissions by segment further emphasises the relatively poor performance of the 4x4/SUV segment, even when smaller types of vehicles in the class (such as the Toyota

RAV4) are included and allowing for the rapid adoption of diesel engines in the segment. In passing, it should be noted that while diesel engines offer improved CO₂ performance, they are problematic in terms of NO_x and particulate emissions, both of which have significant air quality repercussions and impacts on human health. Thus, in 2003 the segment CO₂ emissions performance was as shown in the table on page 16.

54. The segment as a whole is, other than luxury vehicles, the segment with the highest average CO₂ emissions. Luxury vehicles constitute a much smaller part of the overall market (about 0.5% of the total). Those emissions would have to be reduced by 57% to reach the target of 140 g/km. The performance of the Land Rover Discovery and Range Rover models is worse than the segment average. The basic data are shown above right.

Model	Variant	Engine	CO ₂ emissions g/km
Discovery	V8 S	Petrol	354
	V8 SE	Petrol	354
	V8 HSE	Petrol	354
	TDV6 5st	Diesel	249
	TDV6 7st	Diesel	249
	TDV6 S	Diesel	249
	TDV6 SE	Diesel	249
	TDV6 HSE	Diesel	275
	Range Rover	4.2 V8 Super	Petrol
4.4 V8 SE		Petrol	352
4.4 V8 HSE		Petrol	352
4.8 V8 Vogue		Petrol	352
4.8 V8 Vogue SE		Petrol	352
TD6 SE		Diesel	299
TD6 HSE		Diesel	299
TD6 Vogue		Diesel	299
TD6 Vogue SE		Diesel	299

CO₂ Emissions performance of the Land Rover Discovery and Range Rover models (Source: What Car, November 2005)

55. All the above models and variants are above the sector average for CO₂ emissions. In general, the variants with the diesel engine give lower CO₂ emissions than the petrol variants and it is to be expected that the majority of sales would be diesel variants. The worst performing variant in terms of CO₂ emissions is the Range Rover 4.2 V8 Supercharged model, with 376 g/km CO₂ emissions. This is 2.7 times more than the 140 g/km target and more than 2 times the average for the UK new car market as a whole. Note that the Discovery TDV6 HSE comes with an automatic transmission as standard, and demonstrates the fuel economy penalty of such a transmission with 275 g/km compared with 249 g/km for manual transmission. Automatic transmission can be specified as an option on the other diesel variants of the Discovery, but actual fitment rates are not known.

56. The task of transporting 5 people can be accomplished by a Toyota Prius petrol-electric hybrid, which has only 104 g/km CO₂ emissions. The Land Rover Discovery and Range Rover models are between 2.5 and 3.7 times worse in terms of CO₂ emissions. An important consideration is that once these vehicles are in the UK fleet of cars in use, they will remain in use for many years so that the fuel economy penalty is an enduring one.

57. The tables on pages 13 and 14 are taken from the UK Vehicle Certification Agency web site, and list the petrol and diesel vehicles with the lowest CO₂ emissions on the UK market.

58. Evidently, therefore, the models in question are both poor performers in terms of fuel economy compared with vehicles overall, and representative of a segment

Segment	Model	Fuel	CO ₂ g/km	Segment average CO ₂ g/km
Mini	Smart	Petrol	113	138
Supermini	Citroen C2	Diesel	108	147
Lower Medium	Toyota Prius	Petrol/Electric	104	166
Upper Medium	Skoda Octavia	Diesel	138	181
Executive	Audi A6	Diesel	154	211
Luxury	Mercedes S320	Diesel	204	272
Sports	Honda Insight	Petrol/Electric	80	222
4x4	RAV4	Petrol	175	244
MPV	Peugeot Partner	Diesel	152	195

Segment average and lowest emitting models in each segment in the UK, 2003

that as a whole is a cause for concern. The sheer size and weight of these models, and of all the models in the 4x4/SUV segment, is in itself a significant barrier to improving fuel economy.

Most importantly, any such technology to improve fuel economy in the large 4x4/SUV segment vehicles would yield even greater efficiency if applied to ordinary passenger car vehicles. However, it is worth considering what Land Rover might have done in a technical sense, as a socially responsible company, to mitigate the situation by improving fuel economy. There are several technical options available. These include:

- Weight reduction
- Alternative fuels
- Cylinder design engineering-activation
- Part-time 4x4
- Mild hybrid and stop/start cut out systems
- Full hybrid

59. The fuel economy measures outlined below would not contribute to an improvement in the safety performance of the vehicles.

60. Weight reduction offers some scope to improve fuel economy, but in the case of the Land Rover Discovery and Range Rover models the scope for such reduction is

'It is worth considering what Land Rover might have done in a technical sense, as a socially responsible company, to mitigate the situation by improving fuel economy'

limited by the technical choices made and by the simple reality of being large 4x4 vehicles. The models do employ aluminium in the body structure, but are still heavy vehicles by any standard. The maximum kerb weights are: for the TDV6 manual 2,708 kg; the TDV6 automatic 2,718 kg; and the V8 petrol, 2,704 kg (Land Rover, 2005). Added weight is contributed by many factors other than the basic design configuration, notably for example the 13 speaker sound system, the provision of

Brand	Model	Registrations	Segment Share
Land Rover	Freelander	21,657	12.1%
Toyota	Rav 4	15,660	8.7%
Honda	CR-V	13,025	7.3%
Land Rover	Discovery	11,436	6.4%
Nissan	X-Trail	11,029	6.1%

The top five registered cars in the dual purpose – 4x4/SUV segment, 2004. (Source: SMMT, 2005)

seven full-size seats, and the widespread use of electric motors in items such as the windows and the seats. Other features also increase fuel consumption. These include power assisted steering, which is an absolute necessity for a vehicle of the size and weight of the two Land Rover models; and air conditioning, which is necessary if the vehicles are to be sold as 'luxury' models. In other words, these aspects of poor fuel economy derive from the design and market positioning of the vehicles and are the inevitable consequence of trying to match offroad performance with the levels of comfort and convenience expected by those that are in reality going to drive the vehicles in urban areas.

61. A different design strategy, for example with an aluminium frame and plastic composite body panels, could yield significant weight reduction that would in turn allow a weight reduction spiral as other components and systems could also be reduced in weight.

62. Alternative fuel vehicles offer some improvements in overall emissions performance. The UK Vehicle Certification Agency web site has the following information with respect to alternative fuels:

'The different fuels have different merits from an environmental perspective. Compared to petrol, diesel vehicles have significantly lower CO₂ emissions per kilometre travelled because of the higher efficiency of diesel engines and hence have a lower impact on climate change. Diesel vehicles also emit lower levels of CO₂ and HC than equivalent petrol vehicles. However diesel engines emit greater levels of NO_x and Particles than new petrol vehicles. As mentioned earlier, emissions of such pollutants are an air quality issue, particularly in urban areas.'

'LPG and CNG cars are generally converted from petrol fuelled cars, either by the original manufacturer or by an aftermarket converter. For reasons of practicality, CNG

and LPG vehicles tend to be bi-fuel vehicles, which means they can run on either petrol or the gaseous fuel. LPG fuelled vehicles tend to fall between petrols and diesels in terms of CO₂ performance, this is due to the lower carbon and higher energy content by mass of the fuel. In addition LPG vehicles tend to have lower CO and HC emissions compared to an equivalent petrol vehicle. CNG

'Chrysler claim that by switching the V8 to a V4 configuration fuel savings of up to 20% are possible. Honda developed a 3.0 litre V6 with what the company termed 'Variable Cylinder Management' that is claimed to reduce pumping losses by up to 65%'

offers even lower CO₂ emissions than LPG, typically on a par with diesels. This is coupled with low CO, HC and Particle emissions. The durability of the emissions performance of LPG and CNG vehicles will depend upon the quality of the conversion. New LPG and CNG fuelled vehicles are required to meet the same emissions limits at type approval as petrol engines. As emissions limits for petrol and diesel engine vehicles become tighter the gap in emissions performance between LPG and conventional fuels is narrowing.'

63. Cylinder deactivation systems were first deployed in a 1981 Cadillac, but were withdrawn due to technical and reliability problems. With the advent of modern electronic control and engine management, the concept has been revitalised. Deactivation reduces so-called 'pumping losses' when an engine is not being worked to full capacity. Mercedes launched a system in 1999 on several models using either V8 or V12 engines. The

Mercedes cylinder deactivation system, known as Active Cylinder Control, switches off half the cylinders (thereby the V12 becomes a V6 for example). In essence, the system closes off the valves to the cylinder head, and stops the supply of fuel to the cylinders in question.

64. In the US, the cylinder deactivation technology concept has been applied to the largest of the 'light truck' vehicles produced by Chrysler and by GM. In the latest generation Dodge Ram 1500 pick-up truck, for example, has this technology, as does the Jeep Grand Cherokee (a large 4x4 similar to the Land Rover Discovery and Range Rover). Chrysler claim that by switching the V8 to a V4 configuration fuel savings of up to 20% are possible. Honda developed a 3.0 litre V6 with what the company termed 'Variable Cylinder Management' that is claimed to reduce pumping losses by up to 65%. Honda made a more modest claim for 5% improvement in fuel economy. Vehicles with this technology were launched in the US market and in Japan in 2003.

'If drivers of these large 4x4 vehicles feel 'safer' as is often reported, it is not unreasonable to expect other drivers to feel less safe if they are in normal passenger cars. The rational response is then for all purchasers of new cars to seek to acquire larger vehicles'

65. The GM system is known as Displacement on Demand, launched in 2004 and expected to be fitted to 1.5 million vehicles per annum by 2007 in V8 and V6 form.
66. Mild hybrids and stop-start cut out systems use electric assistance to accelerate a vehicle from rest. In the US, GM has been active in developing this technology that, in their application, is known as a Belt Alternator System (GM, 2005). The first application will be an SUV, the Saturn VUE Green Line, to appear for the 2007 model year. Combined with regenerative braking and a modified four-speed automatic transmission it is expected that the BAS will deliver a 12-15% improvement in fuel economy over the basic model. This approach uses an advanced battery to store electrical energy. The combustion engine shuts down when the vehicle is stationary, with secondary power needs (air conditioning for example) supplied by the battery. Electrical assistance is also provided for in acceleration, but otherwise the vehicles run on internal combustion engines. However, in this sort of application the additional impetus given by

the electrical power is used to improve the acceleration of the vehicle, rather than allow the internal combustion engine to be made smaller and thereby improve fuel economy further. Thus, the gains in fuel economy from such 'mild' hybrids depend upon the strategy adopted by the vehicle manufacturer. In general, the mild hybrid approach can be characterised as low cost but with limited benefits. It is however relatively straightforward from a technical perspective.

67. Part-time 4x4 is used to switch off the front-wheel drive element of a four-wheel drive vehicle when all round traction is not required, by disengaging the front-wheel drive shaft. The approach is used in the 2006 Dodge Ram pick-up truck for example. The fuel economy benefit, and hence CO₂ emissions benefit, depends upon the degree to which 4x4 drive is switched off. A reasonable estimate of the difference between a 4x4 version of a model and a two-wheel drive version is for 5-10% lower CO₂ emissions from the two-wheel drive version.
68. Hybrid cars have entered the market in recent years, notably through the efforts by Honda and Toyota. Again, there is a significant benefit in terms of fuel economy. In terms of the vehicles in the same segment as the Land Rover Discovery and Range Rover models, the most relevant model is the Lexus RX400h (Lexus is a Toyota brand). This vehicle is somewhat smaller than the two Land Rover models, but is still a large vehicle and weighs up to 2024 kg in terms of kerb weight. Notwithstanding these points, the Lexus RX400h has a CO₂ performance of 192 g/km. This performance illustrates two points. First, that compared with the Land Rover Discovery and Range Rover models, it is possible to achieve between 23% and 49% lower CO₂ emissions. Second, that even with this technology, the fuel economy figure is still poor – nearly twice that achieved in the Toyota Prius that employs similar technology.
69. In general terms, given a suite of technological measures, substantial improvements in fuel efficiency should be possible. In a major US study for example (DeCicco et al, 2001) it was estimated that a moderate package of measures to include weight reduction, streamlining, low rolling resistance tyres and an integrated starter generator system could yield an improvement of 70% in fuel economy for a typical SUV (actually a Ford Explorer petrol engine V6) for a cost increase of just 4-7%. A more aggressive approach with an 'advanced' SUV design including direct injection petrol engines could yield even greater improvements in fuel economy, with a price rise of about 10%.

E. THE WIDER IMPACT OF THE LAND ROVER DISCOVERY AND RANGE ROVER MODELS

70. While shorter than some estates and MPVs, SUVs as a class clearly take up substantial road space, not least they are often wider than vehicles of a similar length in order to achieve a degree of stability.

71. The Discovery is 4.835 metres long by 1.915 metres wide. With coil suspension and the Alpine roof, the vehicle is 1.882 metres high. These are, therefore, imposing vehicles on the road. The Land Rover publicity literature for the Discovery makes much of the 'command' driving position that 'gives you the advantage of seeing over the traffic ahead and spotting hazards well ahead of time' (Land Rover, 2005 p34). This may well be true, but any driver in a standard passenger car following after the Discovery will experience exactly the opposite. Their view ahead will be obscured, and this will make driving judgements more difficult. All other factors being equal, a large vehicle will obscure more of other traffic, as well as pedestrians and cyclists. There is therefore a secondary safety hazard from the Range Rover and Discovery vehicles.

72. One of the potential wider impacts of the growth in market share of these large 4x4/SUV style vehicles is that of 'segment creep' in response to larger vehicles being on the road. Clearly, this is a difficult feature to quantify, but if drivers of these large 4x4 vehicles feel 'safer' as is often reported, it is not unreasonable to expect other drivers to feel less safe if they are in normal passenger cars. The rational response is then for all purchasers of new cars to seek to acquire larger vehicles than would otherwise be the case, in order to feel 'competitive' on the roads. The result would be a creeping process whereby those that can afford it will shift into larger vehicles, which of course in turn will result in more CO₂ emissions and deaths or injuries from accidents than would otherwise have been the case. The real danger here is that the entire fleet of vehicles in circulation becomes more like that prevailing in the US, and the smaller and more efficient vehicles disappear from the market, going completely against the intention of government policy and the public interest in terms of reducing CO₂ emissions. In this respect, there is a potential for large 4x4 vehicles to have a form of multiplier effect on total CO₂ emissions.

73. While the focus in this report has been on the environmental and safety costs of the vehicles in use, it is also worth noting that there is a disproportionate manufacturing and materials cost to larger vehicles. That is, the Land Rover Discovery and Range Rover

require more steel, glass, aluminium, rubber, plastic and so on than smaller vehicles. In this respect, the vehicles are resource-intensive. This factor is augmented by the fact that when consumable items are replaced or replenished, again more resources are required: examples include brake pads, tyres, oil, and windscreen wipers.

'Land Rover appear to have moved beyond their heritage to embrace urban use. The Sport model was advertised with a strap line promoting an "awesome tarmac performance"'

74. The large 4x4 also carries a financial cost to other road users in the event of an accident, as demonstrated by research at the UK Motor Insurance Repair Research Centre (commonly known in the industry as the Thatcham research centre, after its location). This centre conducts low-speed tests on vehicles to assess how easily they sustain damage, and how repairable they are subsequently. In 2005 the centre tested large SUVs in low-speed collision (10 mph) with typical superminis (Thatcham, 2005). The report said:

'Off road vehicles (4x4s) or SUVs are becoming increasingly popular but these are an even bigger problem. Most have a much higher bumper so in a crash they 'override' an ordinary car's bumper, causing massive repair costs.'

Thatcham gave the example in which:

'A modern large SUV (4x4) was crashed at just 10 mph into another vehicle from the same manufacturer. The problem was not the size and weight of the striking car. The bumper of the SUV is much too high and missed the bumper system of the supermini altogether...during the crash...the sturdy bumper of the SUV ripped into the hatchback of the supermini creating massive damage.'

The damage was estimated at £4,200. A similar result was obtained when the supermini was crashed into the SUV.



Selling the dream: Land Rover advertising emphasises pristine wilderness (Source: Land Rover)

F. MARKETING AND THE LAND ROVER DISCOVERY AND RANGE ROVER MODELS

75. As noted in section A, there are various definitions of the market segment within which the two models are placed. Under the definition used by the industry

'This style of advertising is not uncommon. Indeed for many vehicles in the 4x4/SUV segment it is standard practice to portray vehicles standing majestically in pristine natural environments'

representative body, the SMMT, in 2004 the 'dual purpose – 4x4/SUV' segment comprised 179,439 new car registrations. This compares with 73,940 sports cars, and 13,620 luxury cars. The segment overall comprised 7.0% of the market in 2004, up from 3.9% in 1996 (SMMT, 2005).

76. The leading five cars in the segment in 2004 are shown in the table on page 17. The Land Rover Discovery was the market leader in large 4x4 vehicles. In 2003, Land Rover's UK registrations excluding the Defender were 41,056 vehicles and can fairly be said to epitomise the segment in the UK market.

77. In the automotive industry, as in many others, brands play an important part in informing consumers of the qualities and attributes of the product. Heritage is often an important ingredient, particularly in the more expensive vehicles. In the case of Land Rover the brand has for some time been based on the notion of 'The best 4x4 by far'. That is, the four-wheel drive characteristic is fundamental to brand positioning. The heritage of the brand derives from the original Land Rover Defender model, a robust but utilitarian 'workhorse' used by the military, by farmers, and by government agencies, companies, etc. for situations where normal tarmac roads are not available. The strap line on Land Rover advertisements at the moment is 'go beyond', with the implication that these vehicles are not constrained in the way that mainstream cars are.

78. Land Rover appear to have moved beyond their heritage to embrace urban use. The Sport model was advertised with a strap line promoting an 'awesome tarmac performance.' While this strap line has now been dropped in the UK, it would still appear to be in use in other countries. For example, in Australia the official website claims:

'Range Rover Sport is an exceptional sports tourer that excels onroad and off, delivering awesome power for a thrilling, involving drive.' (Land Rover Australia, 2005).

79. Land Rover has also advertised other models in its range in a manner that seeks to encourage urban usage. For example, an advertisement in the Daily Mail on

Thursday 14 October 2004 for the Freelander model claimed that the vehicle is: '*At home in tropical rainforests and concrete jungles.*'

80. The Discovery and Range Rover models seek to add to that functional capability the notion that the vehicles are both luxurious and embody high technology. The marketing literature reflects these concerns, as does the price positioning of the models. While the Defender model has a UK retail price in the range £20,495 to £27,995, the Discovery is £26,995 to £48,995 and the Range Rover is £46,000 to £73,000.

81. It is evident from the Land Rover corporate website, and from the promotional literature, that the go-anywhere promise of the models is the primary claim to distinction. Photographs of the models portray almost universally scenes bereft of other human features, with vehicles positioned within actual or stylised remote terrains. This is important because the emotional value of brands is often as crucial as the tangible content. In this respect, brands represent life-style statements for consumers, they are public statements for consumers wishing to establish to the wider social world their values and status.

82. This style of advertising is not uncommon. Indeed for many vehicles in the 4x4/SUV segment it is standard practice to portray vehicles standing majestically in pristine natural environments. In effect, the idea of the 'freedom of the open road' so often promised in mainstream car advertising has been replaced, a frank acknowledgement that our roads today are so congested that such a freedom is utterly unrealisable. In stead, these images offer the prospect of the 'freedom of the open countryside'. Clearly, this too is unrealisable in reality, after all not many vehicles sold in the UK are going to spend time under the Northern Lights. However, the emotional and aspirational content is important. The owners may indeed trundle around the M25 or the A406 along with every other vehicle, but the dream is of romping across the Arctic tundra.

83. Part of the marketing package is to offer purchasers and owners of Land Rover cars driving days at the various Land Rover 'Experience' centres around the UK. There are nine in total. These centres may be portrayed as places where the uninitiated may learn to control and exploit the vehicles, and thereby be prepared for the occasion when they do go 'offroad'. Alternatively, they could be seen as an admission that apart from specially provided sites there is nowhere that the average new vehicle buyer could legitimately take their vehicle offroad.

G. REFERENCES

- Ballesteros, M. F.; Dischinger, P. C.; Langenberg, P. (2004) Pedestrian injuries and vehicle type in Maryland, 1995-1999, *Accident Analysis and Prevention*, 36(1), 73-81.
- Buettner, R. and Lisberg, A. (2005) Tragic victims of SUV menace, *New York Daily News*, accessed from www.nydailynews.com/11-13-2005/news/v-pfriendly/story/364931
- DeCicco, J.; An, F. and Ross, M. (2001) Technical options for improving the fuel efficiency of US cars and light trucks by 2010-2015, Washington: The Energy Foundation.
- Dobson, R. (2003) Advances in medical technology account for a third of the reduction in road traffic deaths, *British Medical Journal*, 326, 1004.
- GM (2005) Belt Alternator Starter Hybrid System, pdf from www.gmability.com Accessed 15th October 2005.
- IIHS (2004) *iihs_news_100304.pdf* Report obtained from Insurance Institute for Highway Safety via www.hwysafety.org
- IIHS (2005) *iihs_news_030605.pdf* Report obtained from Insurance Institute for Highway Safety via www.hwysafety.org
- Land Rover (2005) Discovery 3, Gaydon: Land Rover publication number LRML 2188/05.
- Land Rover web site. www.landrover.co.uk Accessed 15th October 2005.
- Land Rover Australia (2005) www.landrover.com/au Accessed 12th December 2005.
- Lefler, D.E.; and Gabler, H.C. (2004) The fatality and injury risk of light truck impacts with pedestrians in the United States, *Accident Analysis and Prevention*, 36(2), 295-304.
- Pless, B. (2004) Editorial, *British Medical Journal*, 328, 846.
- Roudsari, B. S.; Mock, C. N.; Kaufman, R.; Grossman, D.; Henary, B. Y. and Crandall, J. (2004) Pedestrian crashes: higher injury severity and mortality rate for light truck vehicles compared with passenger vehicles, *Injury Prevention*, (10), 154-158.
- Simms, C. and O'Neill, D. (2005) Sports utility vehicles and older pedestrians, *British Medical Journal*, 331, 787-788.
- SMMT (2004) Motor industry data – 2004, London: Society of Motor Manufacturers and Traders.
- SMMT (2005) Motor industry facts – 2005, London: Society of Motor Manufacturers and Traders.
- Starnes, M. and Longthorne, A. (2003) Child pedestrian fatality rates by striking vehicle body type: a comparison of passenger cars, sport utility vehicles, pick-ups, and vans, Washington: National Center for Statistics and Analysis. DOT HS 809 640.
- Thatcham (2005) Bumpers, pdf obtained from the Motor Industry Repair Research Centre via www.thatcham.org
- WHO and World Bank (2004) World report on road traffic injury prevention. Geneva: World Health Organisation.

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