Ecological Footprint & Carbon Audit of Radiohead North American Tours, 2003 & 2006

July 2007

THE QUEEN'S AWARDS FOR ENTERPRISE: SUSTAINABLE DEVELOPMENT 2005

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Commissioned by

Courtyard Management

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Executive Summary

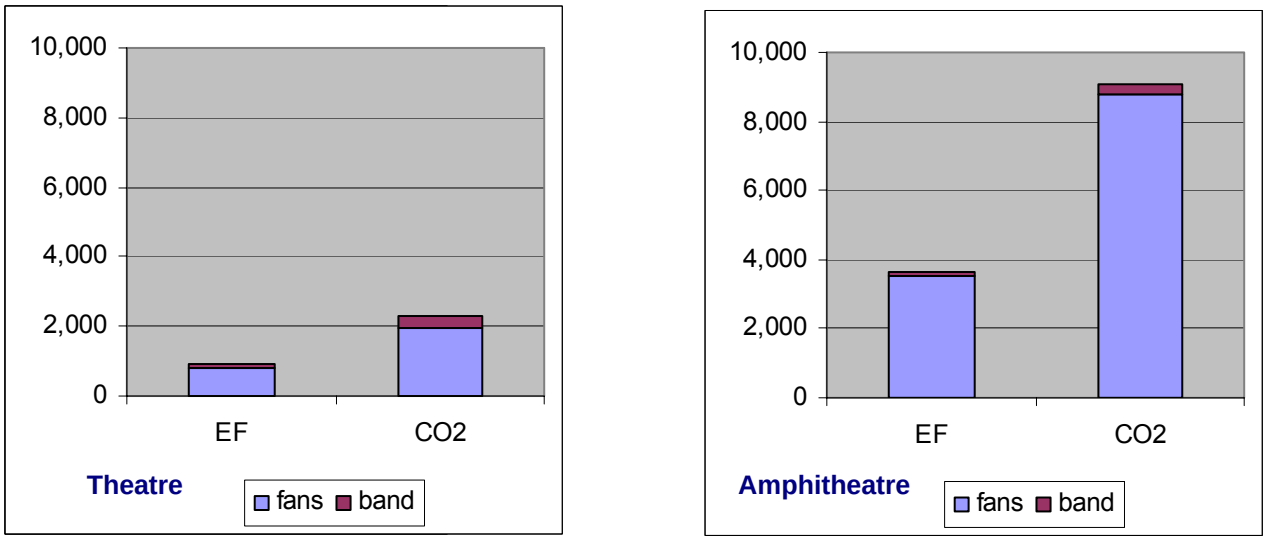
Fan travel and consumption make up 86% of the Theatre tour and 97% of the Amphitheatre tour.

Of the band's touring impact –
Travel and energy use account for 60% (Theatre tour) and ~40% (Amphitheatre tour)
International travel accounts for a further 34 – 40% of impacts.

The total impacts of these tours, expanded from the sample of six and four shows respectively, are given below.

Whole Tour	Tonnes CO_2	Ecological Footprint (gha)
2006 Theatre tour	2,295	902
2003 Amphitheatre tour	9,073	3,655

Figure 1.1 – Impact of band and fans



As can be seen in Figures 1.2 and 1.3, the main impact of both tours comes from fan travel (but note that this is a very rough estimate) – and this makes sense, considering that there are nearly a quarter of a million people turning out on the Amphitheatre tour, and 70,000 on the Theatre tour, mostly driving high-emission US cars.

The main band impacts are in air travel, both international and in the US. Chartered planes alone accounted for 35% the band's travel impact on the Theatre tour. Travelling by train across the US would reduce the band's total impact by about 26% (or 33% excluding chartered planes), and just switching freight from truck to rail would save around 20%. Shipping equipment instead of air-freighting would save 47 tonnes, or 15%, of the band's CO_2.

There are opportunities for the band to reduce its own impacts and to try to influence the behaviour of fans. The most immediately effective way to reduce fan impacts would be to increase the car occupancy so that all fans arriving in cars are sharing a ride with at least two other people.

Figure 1.2 - Total Ecological Footprint and CO_2 emissions, Theatre tour 2006

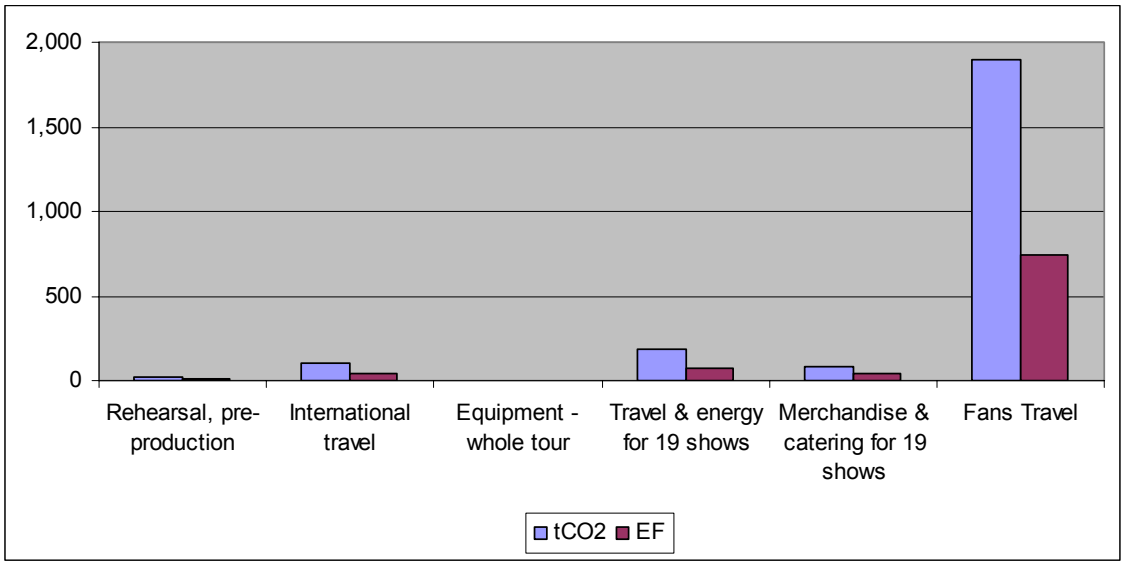
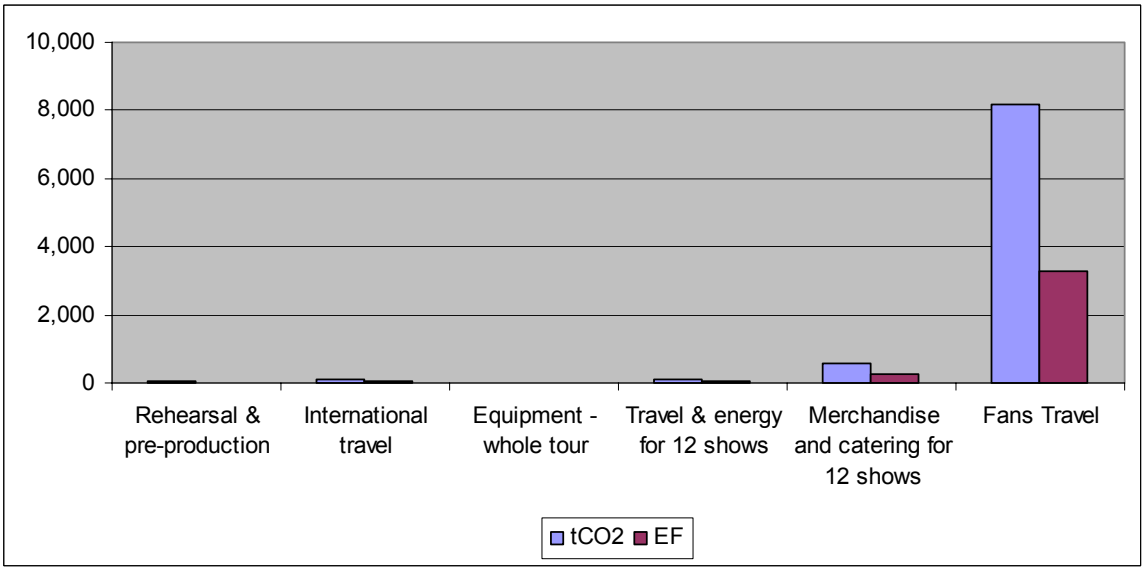


Figure 1.3 – Total Ecological Footprint and CO_2 emissions, Amphitheatre tour 2003



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Introduction

Radiohead and Courtyard Management are interested in examining the ecological and carbon impacts of the band touring. They have commissioned this initial study to obtain a baseline against which to develop a strategy for reducing the impacts of future tours.

This study analyses data from portions of two of Radiohead's North American tours. These are scaled up to represent the entire tours, and split into various components of touring. From this, it identifies the main sources of impact. Each major section of this report considers a different aspect of Radiohead's North American tours, and examines its associated Ecological Footprint and CO_2 emissions.

Footprinting has been successfully used to assess and communicate the environmental impacts of countries, regions, cities, organisations, lifestyles and products. It has proven to be a resonant and accessible indicator of sustainability, which is often seen to be a complex and intangible concept. Carbon Footprinting considers the emissions associated with the final consumption of a product or service, no matter where in the life cycle those emissions occurred and, more importantly, where in the world they occurred. Ecological Footprints are measured in global hectares (gha), to represent the amount of land required, on a global scale, to provide the resources and absorb the CO_2 associated with a particular activity. Carbon footprints are expressed as kg or tonnes of CO_2. See Appendix C for a more detailed explanation of this.

Creating a LOW footprint economy

The footprint of a particular activity or product is a measure of its impact on the environment over its entire 'life cycle'.

The higher the consumption of natural resources (energy and materials) the greater the footprint.

For our national economy to be sustainable in the longer term, then our consumption of resources needs to be reduced by about 80%.

Best Foot Forward refer to this as Living on One World – or a LOW footprint.

More information about LOW footprints can be found at: www.bestfootforward.comH

About Best Foot Forward

Best Foot Forward (BFF) are one of Europe's leading sustainability consultancies specialising in energy and natural resource accounting methodologies such as resource flow analysis, ecological footprinting and carbon accounting.

BFF have undertaken more than 300 footprint studies for government, business and civil sector organisations. These range from large projects such as regional studies of Scotland, Northern Ireland and the South West of England, a corporate study of the National Health Service, through product analyses of packaging, drinks, electronic goods and furniture, to auditing the operations of numerous organisations. BFF methodology conforms to the *Global Footprint Network Footprint Standards 2006*.

Best Foot Forward were awarded a Queen's Award for Enterprise in Sustainable Development in April 2005. This extremely prestigious Award is for continuous achievement in sustainable development based on ecological footprint analysis, and recognises that Best Foot Forward is a global leader in ecological footprinting.

See Appendix C for an explanation of the BFF (Stepwise) methodology.

Total Impacts of Radiohead US Tours

Fan travel and consumption make up 86% of the Theatre tour and 97% of the Amphitheatre tour.

Of the band's touring impact –
Travel and energy use account for 60% (Theatre tour) and ~40% (Amphitheatre tour)
International travel accounts for a further 34 – 40% of impacts.

This section gives an overview of the Ecological Footprint and CO_2 emissions for two North American tours: the 2006 Theatre tour and the 2003 Amphitheatre tour. The total impacts of these tours, expanded from the sample of six and four shows respectively, are given below.

Whole Tour	Tonnes CO_2	Ecological Footprint (gha)
2006 Theatre tour	2,295	902
2003 Amphitheatre tour	9,073	3,655

Band Impact	tCO_2	EF
2006 Theatre tour	317	121
2003 Amphitheatre tour	300	120

Per Fan	Fans	tCO_2	EF
2006 Theatre tour	70,000	0.033	0.013
2003 Amphitheatre tour	240,000	0.038	0.015

As can be seen in Figures 2.1 and 2.2, the main impact of both tours comes from fan travel (but note that this is a very rough estimate) – and this makes sense, considering that there are nearly a quarter of a million people turning out on the Amphitheatre tour, and 70,000 on the Theatre tour, mostly driving high-emission US cars.

Leaving aside fan travel and consumption, the main band impact is from air travel, flying into the east coast and leaving from the west coast – nearly 130 tonnes of CO_2 and 60gha for each tour. Chartered planes alone account for 34% of the band's travel impact on the Theatre tour.

Figure 2.1 –Band & Fan impacts for Amphitheatre and Theatre tours

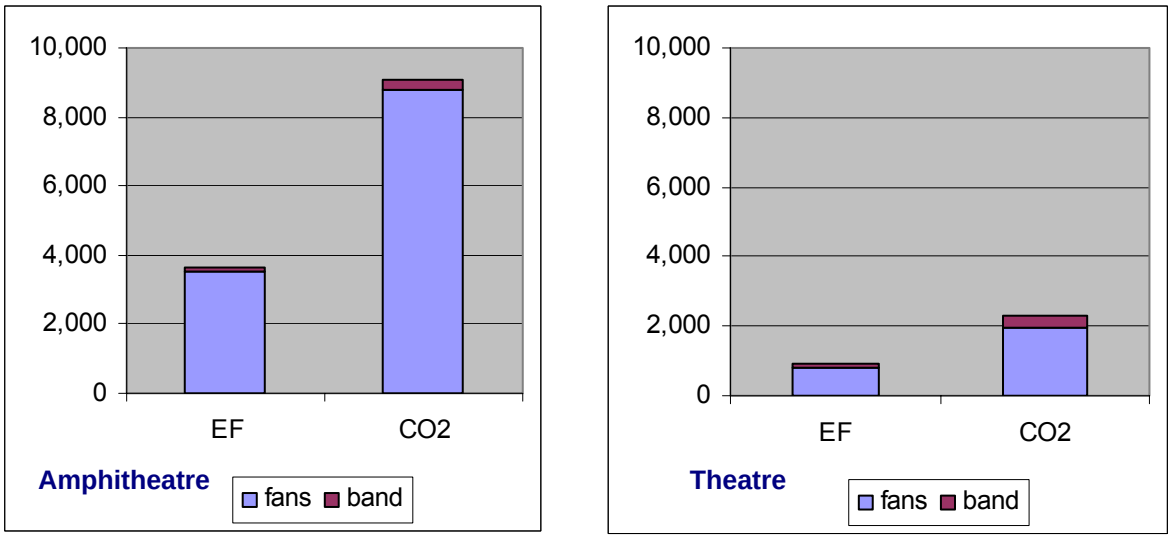


Figure 2.2 – Ecological Footprint and CO_2 Emissions for the band

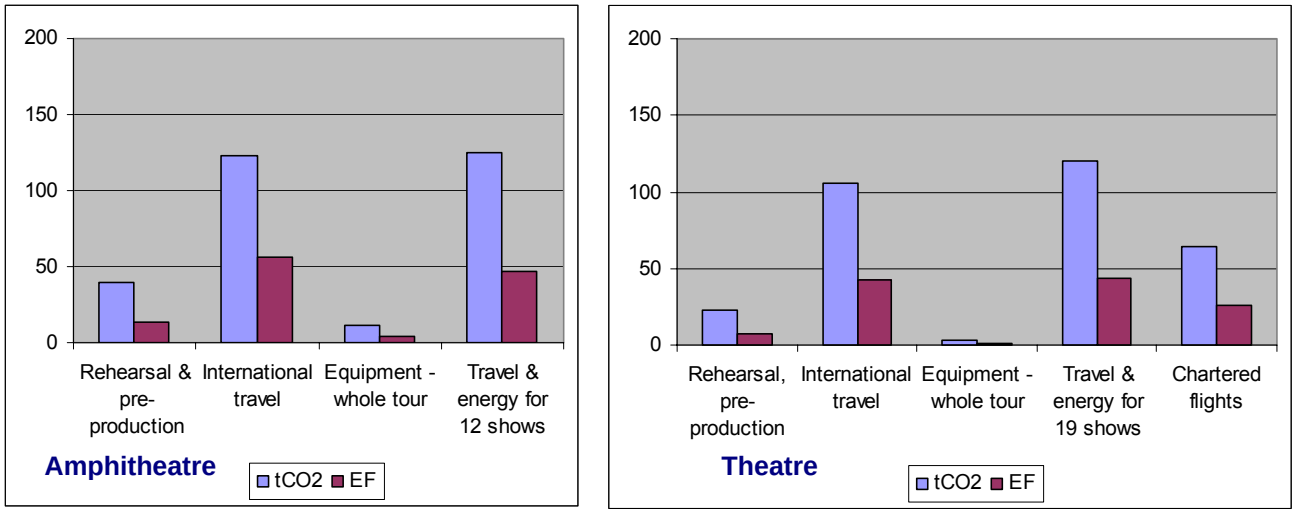
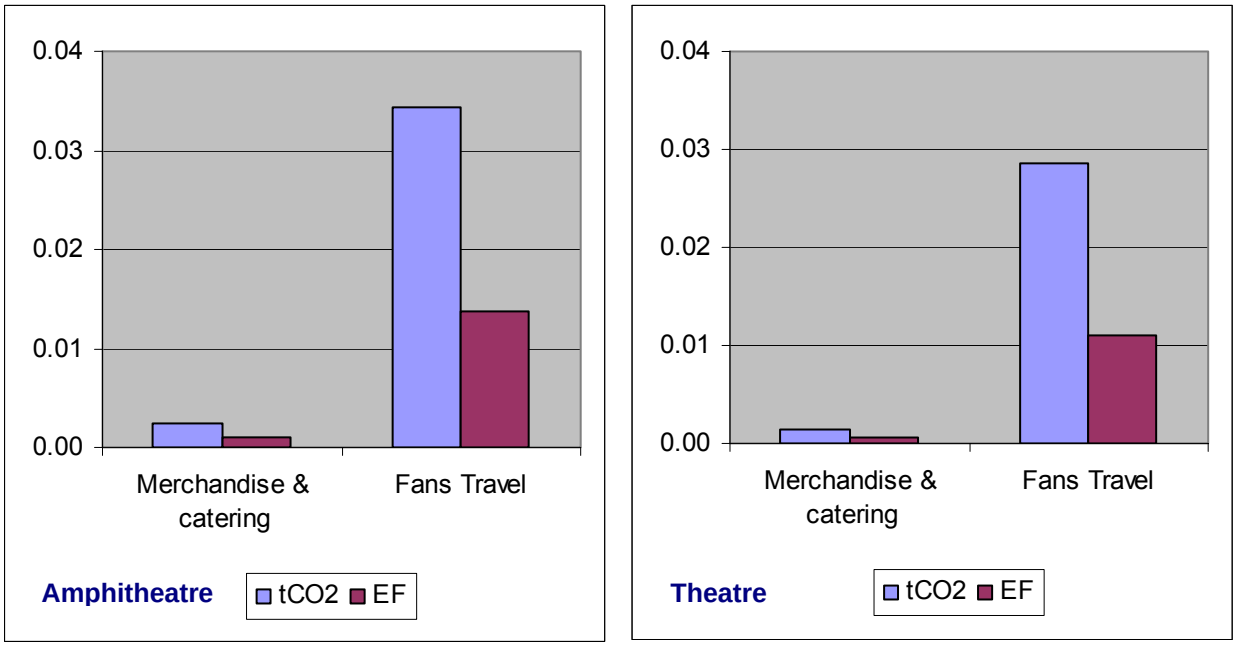


Figure 2.3 – Ecological Footprint and CO_2 Emissions per fan



The following findings may be of interest and may help to identify potential priority areas for action. Note that the figures for fan travel and catering are very roughly estimated.

- Fan travel has by far the largest impact at 86%(2006) and 97%(2003).
- International air travel for the band accounts for about 78 tonnes of CO_2 (2006 & 2003).
- Air freight accounts for about 20 tonnes CO_2 UK – east coast US and 26 tonnes west coast US – UK.
- The chartered planes from New York to Nashville then to Chicago and on to San Francisco added a further 64 tonnes of CO_2.
- Trucks carrying equipment account for 62 tonnes CO_2 (2006) and 73 tonnes (2003).
- Beer for the Theatre tour, estimated at 2 bottles per fan, accounts for 50 tonnes CO_2 while the bottles and plastic glasses account for a further 16 tonnes of CO_2 (2006). Catering, waste and merchandise work out at 1.1 kgCO_2 per fan.
- Beer accounts for nearly 160 tonnes CO_2, and food for an estimated 215 tonnes, for the Amphitheatre tour in 2003. Catering, waste and merchandise work out at 2.7kgCO_2 per fan – this is greater than for the Theatre tour because of the food available at the larger arenas.

Impacts in context

For each tour the band is responsible for CO_2 equivalent to:

- About 120 return flights UK to NY
- Manufacturing 50 cars
- Driving 1,600,000 km in a UK car (160 people driving the UK average) or 900,000 km in a US car
- 140 minutes' worth of Oxford's CO_2.

Fans on the Amphitheatre tour had more impact because there was food available at the venues, and consequently more waste too. We estimated that more of them drove to the concerts.

Fans on the Amphitheatre tour were responsible for CO_2 equivalent to:

- Nearly 4,000 return flights UK to NY
- Manufacturing 1650 cars
- Driving 33,000,000 km in a US car or 50,000,000 km in a UK car
- Running the NHS for 6 hours

Fans on the Theatre tour generated CO_2 equivalent to

- More than 1,000 return flights UK to NY
- Manufacturing 400 cars
- Driving 7,000,000 km in a US car or 1,200,000 km in a UK car

As a proportion of the average US person's impact, a concert is about ⅔ of a day of impact for an event that lasts about ¼ of a day. However when this is compared to a ***global sustainable level*** of CO_2 and Ecological Footprint (EF), the fan is using up about 6 days of CO_2 and 3 days of EF.

Figure 3.1 – Impact of a fan's attendance at one concert – equivalent in days

	Theatre tour 2006		Amphitheatre tour 2003	
	CO_2 emissions	EF	CO_2 emissions	EF
# US days[1]	0.6	0.5	0.7	0.6
# world average days[1]	2.8	2.2	3.1	2.5
# 'sustainable' days[2]	5.9	2.7	6.6	3.1

Entertainment budget

FA Cup Final 2004: impact per fan was roughly twice that of a Radiohead concert, but included twice as much travel impact – so these events are comparable.

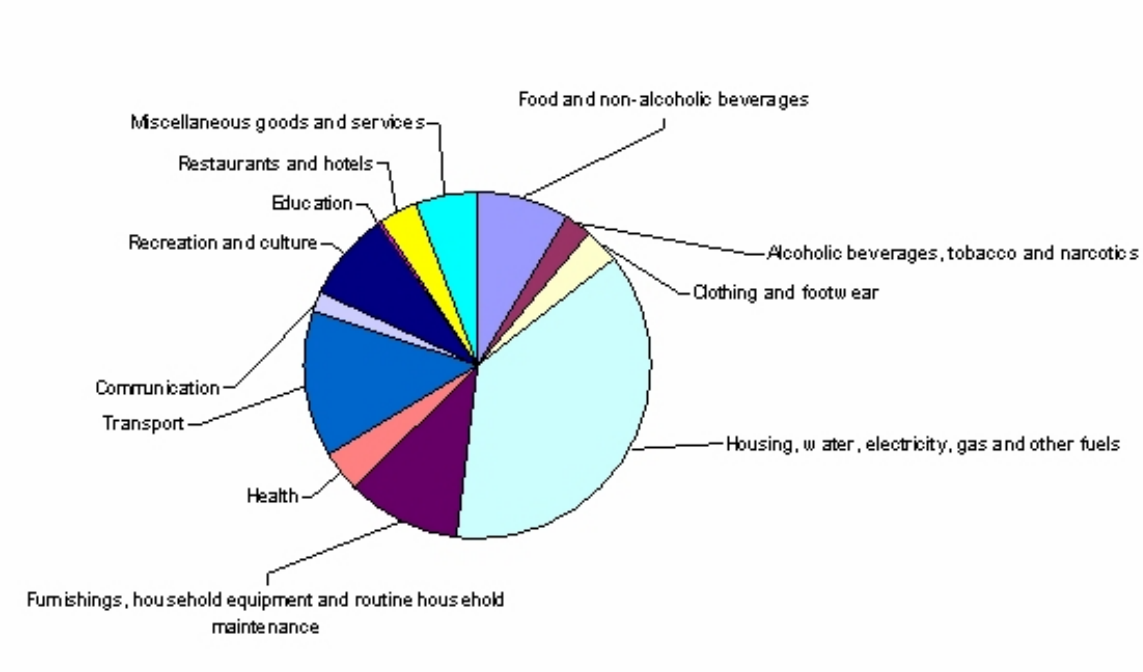
WWF estimates that people in rich countries use about 8% of their CO_2 on recreation and culture, excluding travel. The University of Surrey estimates that recreation and culture accounts for

[1] www.earth-policy.orgH

[2] Stern Review on the Economics of Climate Change, available at http://www.hm-treasury.gov.uk/independent_reviews/stern_review_economics_climate_change/sternreview_index.cfm

about 20%, including travel. By this measure, one Radiohead concert uses about 1% of a US fan's entertainment CO_2 budget.

Figure 3.2 – Personal CO_2 use, by sector, in rich countries

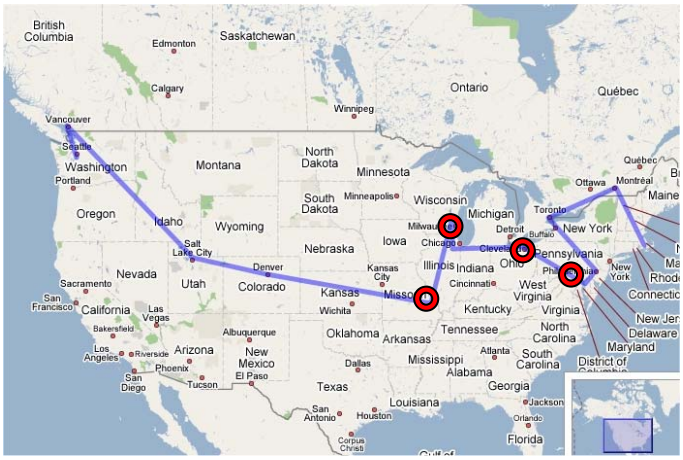


Data Collection

Most data were provided by Richard Young (RY) through Courtyard Management, covering details of six shows on the 2006 tour (in theatres), and four shows on the 2003 tour (in large arenas) of North America.

Amphitheatre tour 2003

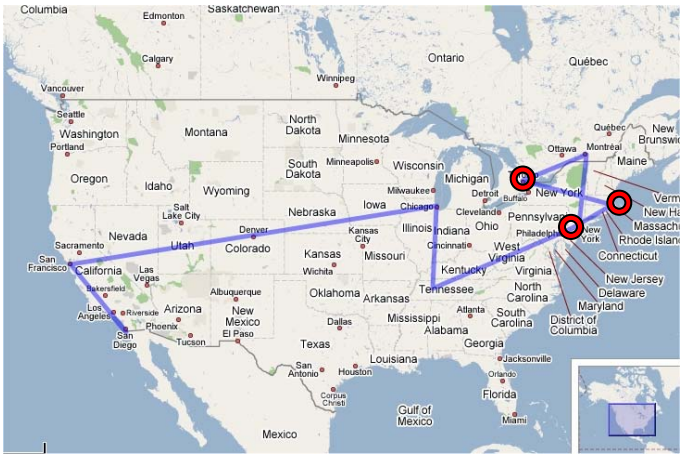
12 shows, ~240,000 fans



- Boston - Tweeter Center
- Montreal - Parc Jean Drapeau
- Toronto - Molson Ampitheatre
- Philadelphia - Tweeter Center
- Columbia - Merriweather Post Pavillion
- Cleveland - Blossom Music Center
- East Troy - Alpine Valley Music Theatre
- St. Louis - UMB Bank Pavilion
- Denver - Red Rocks Amphitheatre
- Salt Lake City - USANA Amphitheatre
- Vancouver - Thunderbird Stadium
- Seattle - White River Amphitheatre

Theatre tour 2006

19 shows, ~70,000 fans



- Philadelphia - Tower Theatre
- Boston - Bank of America Pavilion
- Toronto - Hummingbird Center
- Montreal - Salle Wilred Pelletier at Places des Arts
- New York - The Theatre at Madison Square Garden
- Bonnaroo Festival near Nashville
- Chicago - Auditorium Theatre
- Berkeley - Greek Theater
- San Diego - Bayside
- Los Angeles - Greek Theater

Detailed data were provided for

- Equipment weight and materials
- Band and crew accommodation and travel by air and coach
- Freight movements by air and truck
- Energy consumed by electrical equipment
- Number of fans attending each show.

No information was available for the energy used by the venues for heating and lighting, and BFF could not find a way of estimating it, so it has been left as an unknown in the results. For future studies it is recommended that this should be investigated in more detail.

No solid information was available for some aspects of fan behaviour, so rough estimates have been made by RY and BFF of:

- Fan travelling distances
- Fan modes of transport
- Catering – how much beer and food was consumed by fans
- Waste – how much food and packaging waste was left by fans

Estimating these figures introduces a large uncertainty – did they drink one or two bottles of beer? did they drive 100 or 500 km? Because these are estimates per person, the results have a very wide range when scaled up to total audience figures. For future studies it is recommended that this should be investigated in more detail.

Where other sources have been used this is noted. Details of the base data used, assumptions and calculations applied are contained in Appendix A.

Tour travel & energy

Travel and energy use are responsible for a significant part of the band's touring impact – ~58% for the Theatre tour and ~40% for the Amphitheatre tour
Travel accounts for around 80% of this component.

This section includes data for components which vary according to the number of shows (and their location). Of these, the main impact comes from transport, both trucks and tour coaches, with the chartered planes making up 20% of the band's total impact and 35% of the band's travel impact on the Theatre tour (CO_2).

The Amphitheatre tour (2003) used four tour coaches and five trucks, and the Theatre tour (2006) used three tour coaches and four trucks. Based on the locations of the shows: the Theatre tour covered around 9,200 km, about 6% further than the Amphitheatre tour at about 8,600kms. Emissions for tour coaches have been estimated from US averages[3], with a loading of 20% to cover fuel for generators. Emissions for trucks include mileage and idling time during shows.

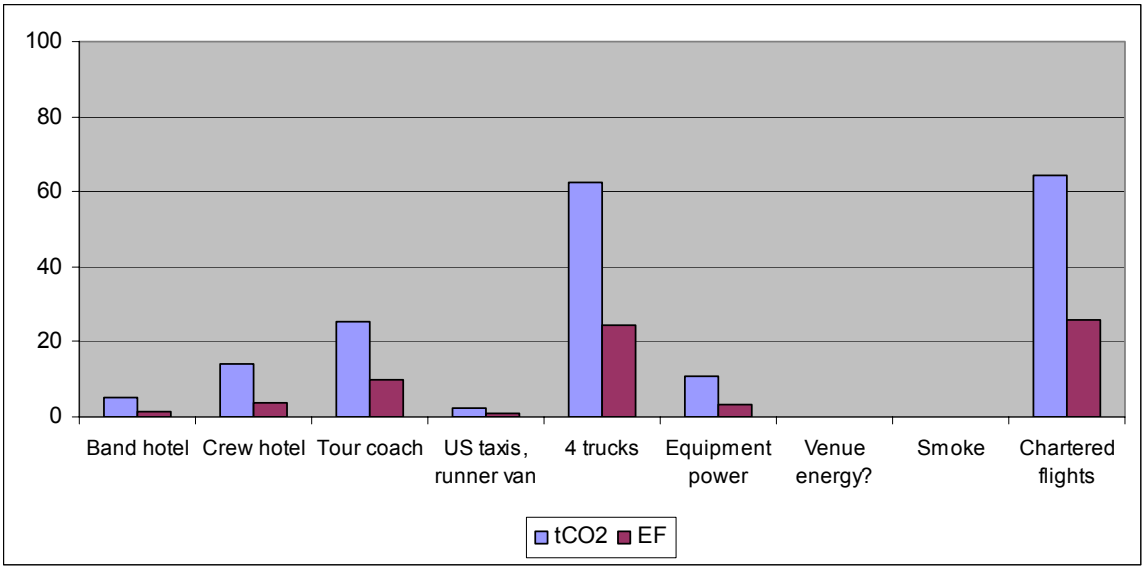
Note that there was no information available about the energy used by venues so this is left as a question-mark, and should be investigated to obtain more accurate data.

Travel impacts

The biggest travel impact is from the chartered planes used on the Theatre tour – 35% of the total travel impact and 20% of the total band impact including rehearsals and international flights[4]. The MD80 from Chicago to Los Angeles accounts for ~57 tonnes CO_2 or 18% of band impact. The small chartered jet from New York to Nashville to Chicago accounts for 7.6 tCO_2 or 2.4% of band impact. Chartered planes accounted for more CO2 than the return international flight from Los Angeles to the UK. See the Band Travel Scenarios section below for further discussion of flying.

The next biggest touring impact is from the trucks. Typically inefficient US vehicles, they are doing 4.5mpg and running generators when not driving. Similarly, coaches are doing 7-8mpg and running generators to provide facilities on board.

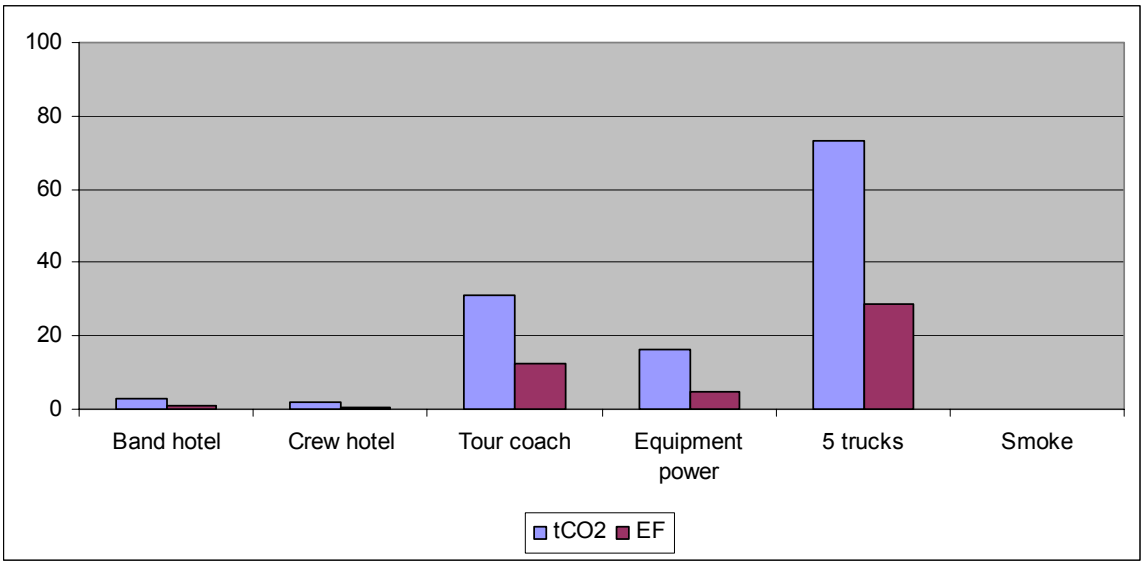
Figure 6.1 – Ecological Footprint and CO_2 emissions of US travel and energy for the Theatre tour 2006



[3] US Bureau of Transportation Statistics

[4] EU Emissions Inventory Guidebook, December 2001

Figure 6.2 – Ecological Footprint and CO_2 emissions for Tour travel and Energy for the Amphitheatre tour 2003



Band Travel Scenarios

Band travel scenarios have been based on the Theatre tour. For the Amphitheatre tour, comparisons are similar to the wheels-only scenario 2.

Scenario 1: replacing chartered flights with scheduled flights
If air travel is necessary, it is better in principle to take scheduled flights as the impacts are shared among all the passengers rather than devoted exclusively to the band. Flying 35 people on scheduled flights Chicago to San Francisco is about **44%** of the impact of the chartered MD80. A smaller plane like a Fokker 50 uses less fuel and might possibly prove more efficient than scheduled flights for 35 people (no detailed data available).

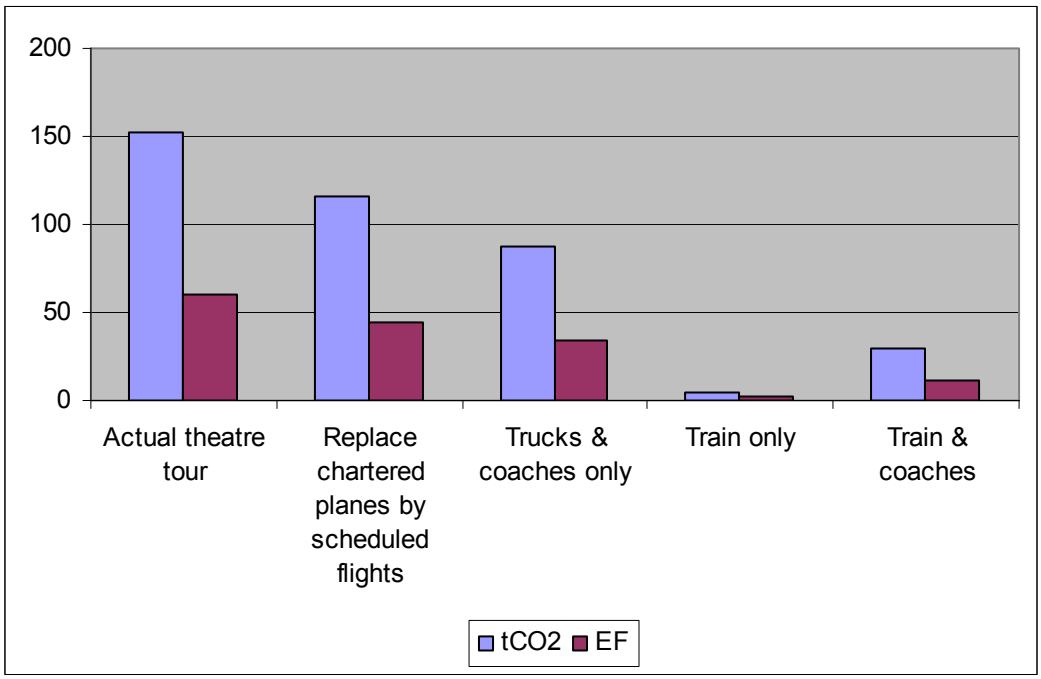
Scenario 2: using trucks and coaches for all Theatre tour transport: no flights
If the Theatre tour had not included the chartered planes, transport impacts would be reduced by about **42%**, **20%** of the total band impact.

Scenario 3: using a train for all personal and freight transport
Chartering a train with sleeping cars and freight cars, using trucks and coaches to shuttle between railway station, venue and hotels would be around **4%** of the actual Theatre tour transport impact and **5%** of the road-based scenario 2. This would save around **46%** of the total band impact. There could be logistical difficulties in loading and unloading the 35 tonnes of kit, but there are Road-Railers[5] trucks which hook onto a train using specialised bogies, and also drive on roads. Security implications are outside the scope of this report.

Scenario 4: using a train for freight with coaches for personal transport
Using a freight train with trucks and coaches to shuttle between railway stations and venues would have impacts of around **20%** of the actual Theatre tour transport impact and **33%** of the road-based scenario 2. This would save around **39%** of the total band impact. Logistical implications as in scenario 3 but personal security considerations would be as now.

[5] http://en.wikipedia.org/wiki/RoadRailerH

Figure 6.3 – Impacts of using scheduled flights, trains, trucks and coaches on the Theatre tour 2006



International travel

International travel accounts for ~40% of CO_2 and ~45% of EF for the band

For both tours the band and crew flew to the US east coast with 6 tonnes of equipment, and the band flew back from the west coast. The equipment was flown back after the Amphitheatre tour (2003), but trucked to New York and shipped after the Theatre tour (2006).

As can be seen in figures 7.1 and 7.2, the freight impact is less than the person impact. These figures do not include a weighting for travelling business or first class, as this is not a DEFRA standard accounting rule[6], but if this was included at double the economy class impact (because business class seats are at half the economy class density), it would increase the person-flying impacts by 26%.

Figure 7.1 – Ecological Footprint and CO_2 emissions for International Travel (Theatre)

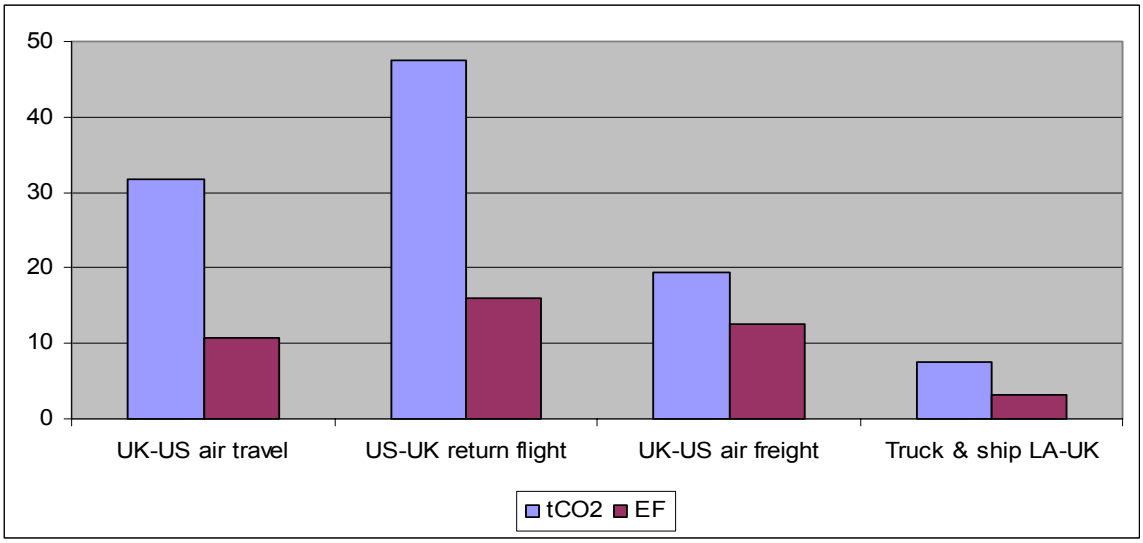
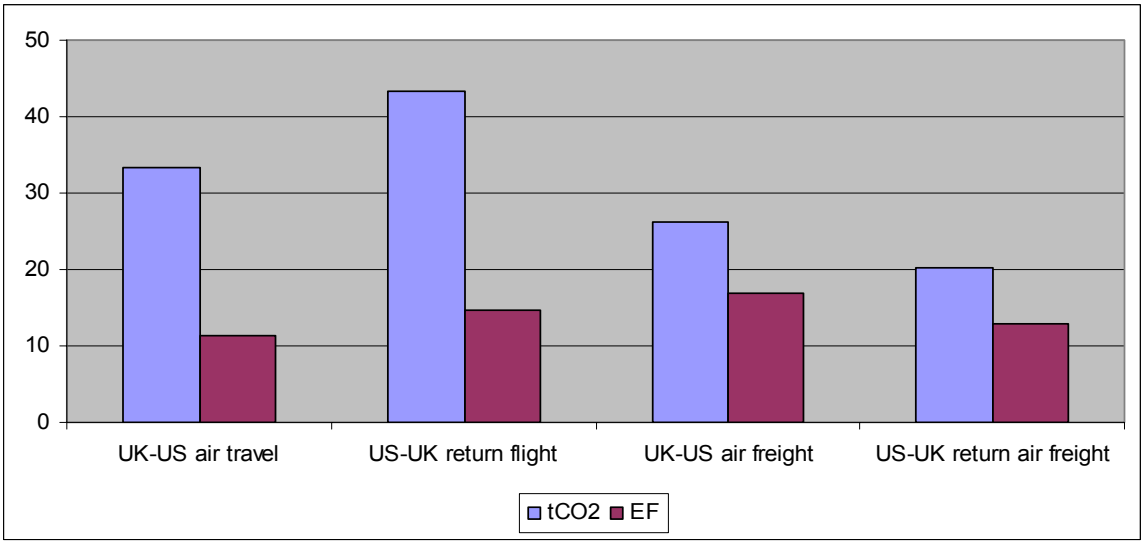


Figure 7.2 – Ecological Footprint and CO_2 emissions for International Travel (Amphitheatre)



[6] *Guidelines for Company Reporting on Greenhouse Gas Emissions* DEFRA, July 2005

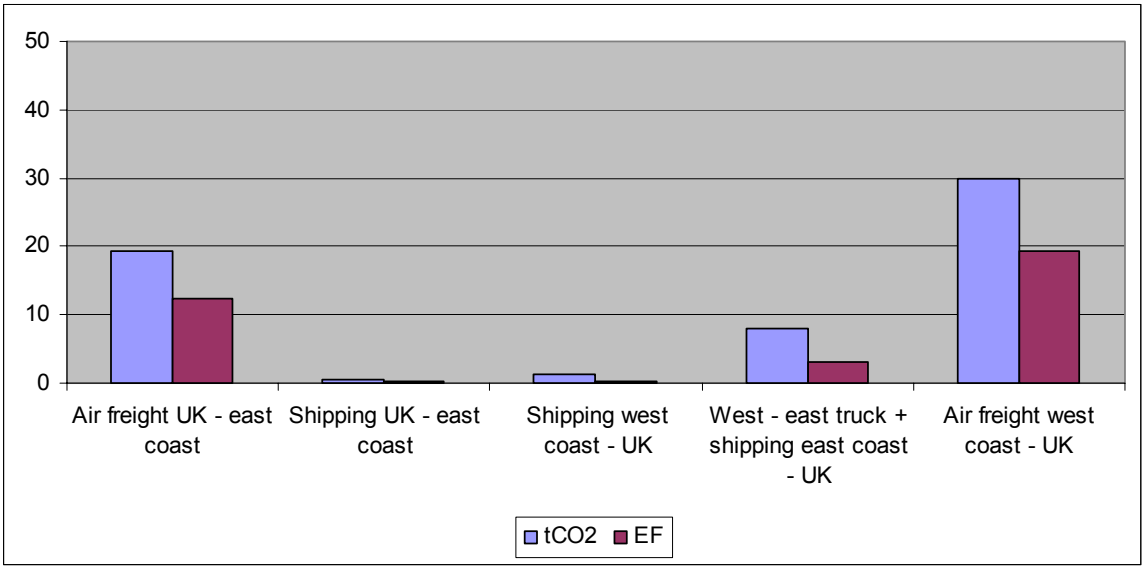
Travel scenarios

For band travel, travelling by sea on a standard cruise ship would create about 35% more emissions per passenger mile than long-haul flights[7]. Passengers on a freighter would have a much lower impact – probably similar to the freight savings – but freighter travel takes about two weeks, is not timetabled as closely as cruises, and tends to have limited facilities for about six people per ship, so probably would not be a realistic alternative.

However there are good environmental (and financial) savings to be made by shipping freight instead of flying it. Sea freight creates only about 3% of the CO_2 emissions of air freight. Figure 7.3 shows a set of freight scenarios.
Scenario 1: flying freight UK to US east coast
Scenario 2: shipping UK to US east coast
Scenario 3: shipping US west coast to UK
Scenario 4: trucking back from US west coast to east coast and shipping to the UK from there.
Scenario 1: flying freight US west coast to UK

- Shipping kit back from the west would save ~29 tCO_2
- Shipping kit both ways would save ~47 tCO_2

Figure 7.3 –Comparative impacts for air, sea and land freight scenarios



[7] Preliminary data from BFF Cruise ship study.

Rehearsal, pre-production, tour set-up

Pre-tour activities are responsible for
~6% of the band's impact for the Theatre tour and
~12% for the Amphitheatre tour

The main impacts of rehearsal, pre-production and tour set-up are from electricity – mostly due to the lighting being on for ~150 hours - and truck miles from US suppliers to the rehearsal or first show.

Unless the rehearsals are taking place 24 hours a day, it would greatly reduce the impacts to switch the lighting off whenever possible. Switching to a 100% green electricity supply[8] at the rehearsal site would remove electricity impacts altogether.

Figure 8.1 – Impacts of Rehearsal, pre-production and US set-up for the 2006 Theatre tour

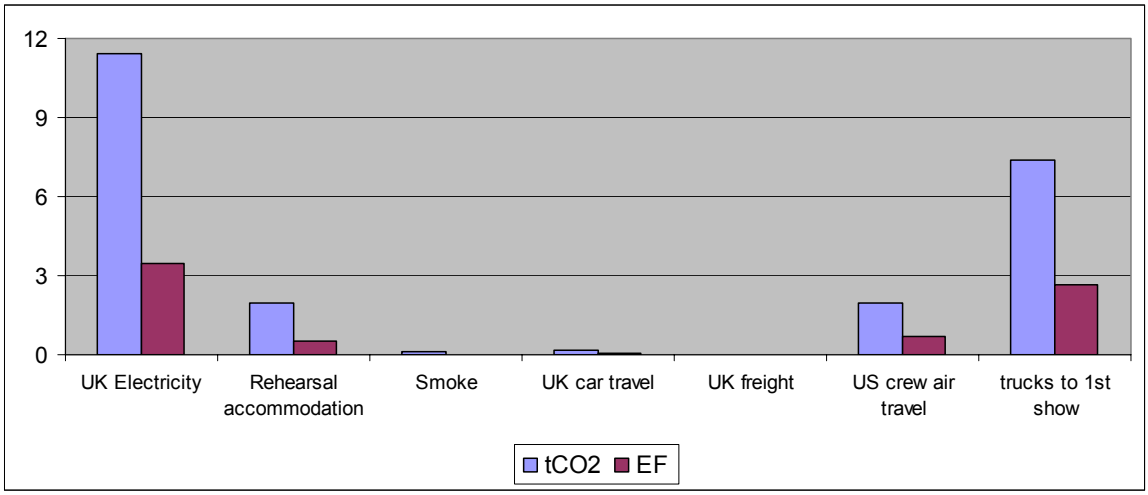
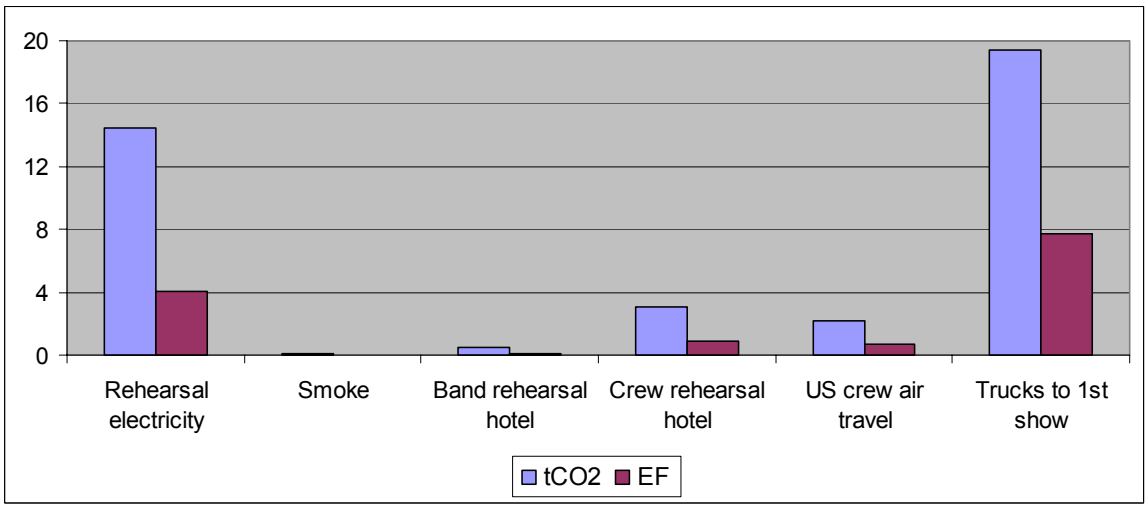


Figure 8.2 – Impacts of Rehearsal, pre-production and US set-up for the 2003 Amphitheatre tour



[8] But note that only three UK electricity suppliers – Good Energy, Ecotricity and Green Energy UK – supply renewables at a level significantly higher than the minimum threshold required under the Renewables Obligation. See also www.est.org.ukH

Equipment

Equipment is responsible for a tiny fraction of the band's touring impact – 3-4% for the Theatre tour and 1% for the Amphitheatre tour

This section covers equipment for the whole tour hired in the UK and the US, and custom-built sets. It does not include the band's instruments. The main impacts are from the electronics used in lighting and video, and the set materials.

The set has high impacts because it is assumed to be used only for one tour. The disposal method for the set will determine its overall impact. Plastic has a high embodied energy and its recycling process does not save much over the original production energy. The metal component is assumed to be steel – aluminium has nearly five times the impact, weight for weight. Recycling steel saves about 75% of its impact.

The impacts of the sound, lighting and video equipment are estimated based on two months out of its expected lifetime (five years for electronics and plastic, fifteen years for wood and steel components). Although the relative impacts of electronics and plastic are high, the use covers only 1/30th or 1/90th of the expected lifespan so the final figures are low.

Figure 9.1 – Ecological Footprint and CO_2 emissions for Equipment (Theatre)

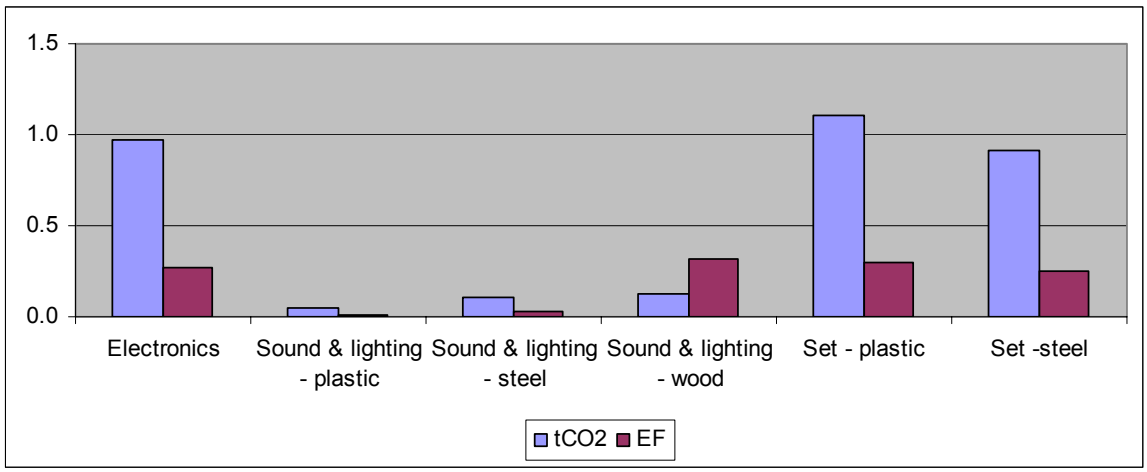
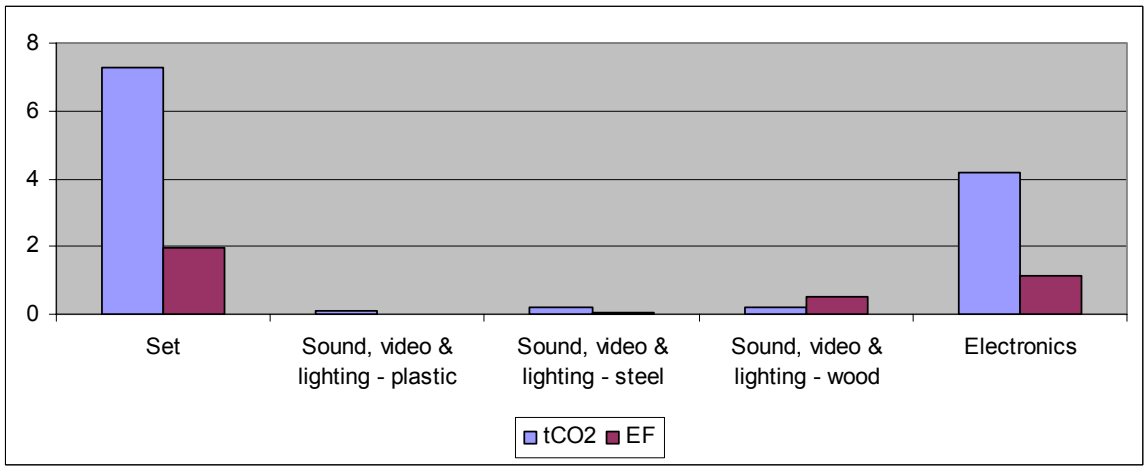


Figure 9.2 – Ecological Footprint and CO_2 emissions for Equipment (Amphitheatre)



Fan Impacts

Responsibility for fan impacts can be debated; there is a view that travel and consumption would not occur if the Radiohead concert was not happening, and the opposite view that the fans would be driving, drinking beer and eating takeaway food in any case, so the band has no direct responsibility.

Fan behaviour is an area where the band do not have direct control but could have some influence, so it is important to quantify the impacts and consider possibilities for reduction.

There is no solid information about fan behaviour, so rough estimates have been made by RY and BFF for

- Fan travelling distances
- Fan modes of transport
- Catering – how much beer and food was consumed by fans
- Waste – how much food and packaging waste was left by fans

Estimating these figures introduces a large uncertainty – did they drink one or two bottles of beer? did they drive 100 or 500 km? Because these are estimates per person, the results have a very wide range when scaled up to total audience figures. For future studies it is recommended that this should be investigated in more detail. Venues and catering franchises should be able to supply at least rough figures for waste and catering.

Even with this degree of uncertainty, fan impacts are hugely greater than band impacts for both tours – about 7 times greater for the Theatre tour with 70,000 fans, and about 30 times greater for the Amphitheatre tour with 240,000 fans. (This means that the band's total tour impacts are equivalent to about 10,000 fans.)

Fan travel

Fan travel accounts for
93-95% of fan impacts
83% of the Theatre tour and 90% of the Amphitheatre tour impacts

Fan travel is the biggest single component of the tours, but is also the component with the least accurate data. All figures here are based on anecdotal evidence regarding the proportion of the audience travelling by each mode (estimated by RY), and the distance travelled on average (estimated by BFF). The Amphitheatre travel profile is almost all by car, whereas the Theatre tour includes about 27% by rail and 1% on foot.

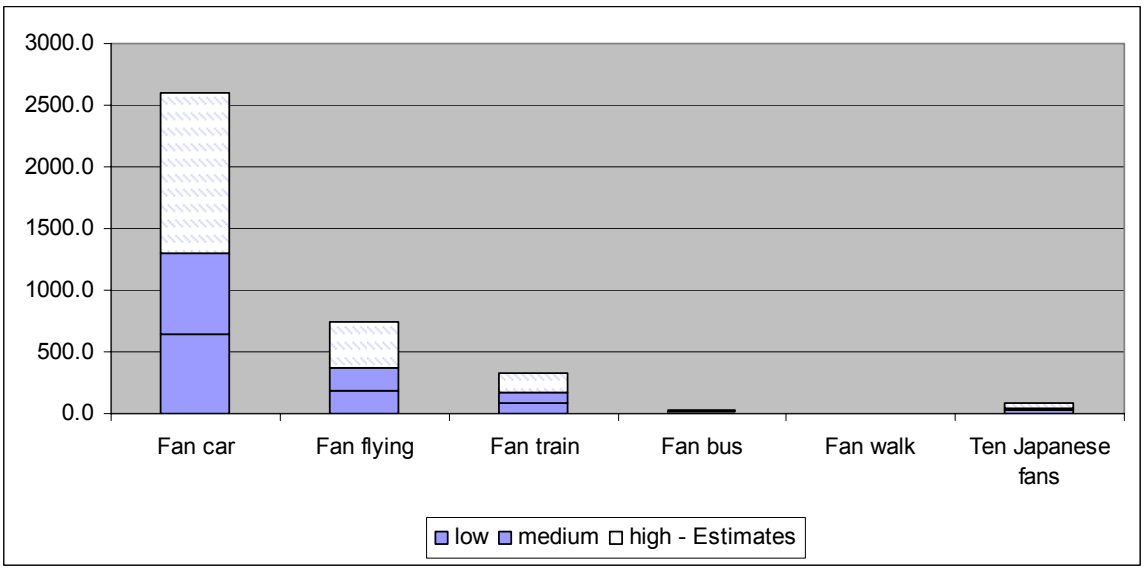
Travel assumed:

Theatre tour:
1% flying[9] 1390 km
61% driving 200km
Car occupancy 2.4: half sharing a ride with one other person, one third sharing with more than one
27% taking the train
10% by bus
10 Japanese fans flying Tokyo – New York return.

Amphitheatre tour:
1% flying[2] 1390km
93% driving 200km
Car occupancy 2.2: most sharing a ride with one other person, only 14% sharing with more than one
6% by bus
10 Japanese fans flying Tokyo – New York return.

Cars dominate the fans' travel impacts, both because a large percentage of fans are expected to travel by car, and because US cars are very inefficient, averaging 22mpg[9] (compared to the UK average 40mpg[10]).

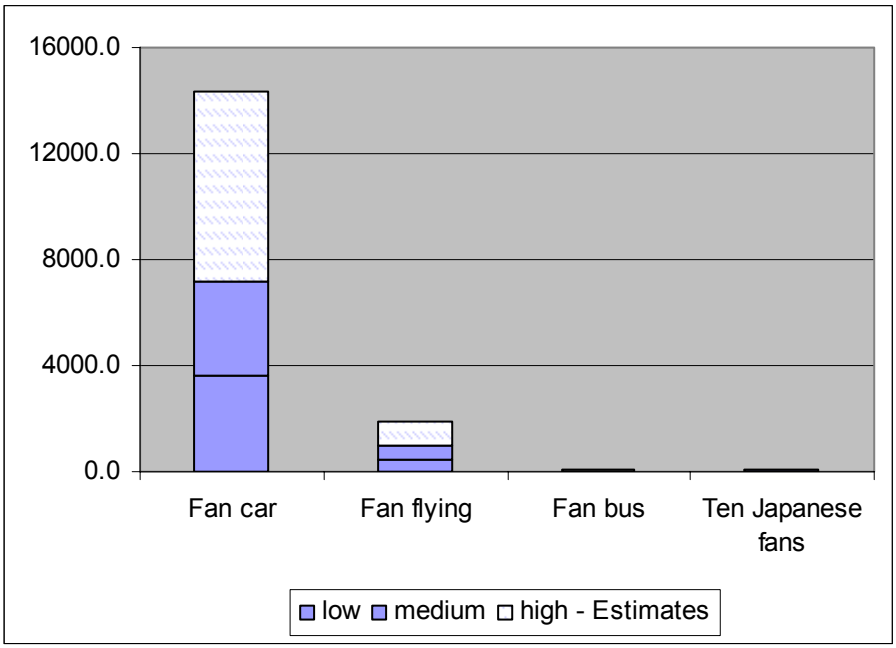
Figure 11.1 – CO_2 emissions for fan travel, by mode, for the 2006 Theatre tour



[9] US average domestic flight – US Bureau of Transportation Statistics (BTS)

[10] *Guidelines for Company Reporting on Greenhouse Gas Emissions* DEFRA, July 2005

Figure 11.2 –CO_2 emissions for fan travel, by mode, for the 2003 Amphitheatre tour



Fan travel scenarios

Scenario 1 (Theatre): Increasing car occupancy from 2.4 to 3 (*73% sharing a ride with more than one other person*)

Scenario 2 (Theatre): Increasing car occupancy from 2.4 to 3.5 (*99% sharing a ride with more than one other person*).

Scenario 1 (Amphitheatre): Increasing car occupancy from 2.2 to 2.5 (*45% sharing a ride with more than one other person*)

Scenario 2 (Amphitheatre): Increasing car occupancy from 2.2 to 3 (*73% sharing a ride with more than one other person*).

Scenario 3: Halving the number of fans flying and replacing them with fans driving.

Scenario 4: Switching 10% of car users to bus.

It can be seen from Figures 11.3 and 11.4 below, that the most effective reductions come from increasing car occupancy rates so that most car users are traveling with two or three other people. Given the lack of US public transport, this is also likely to be the most changeable aspect of fan travel.

Figure 11.3 – Savings from scenarios for the Theatre tour

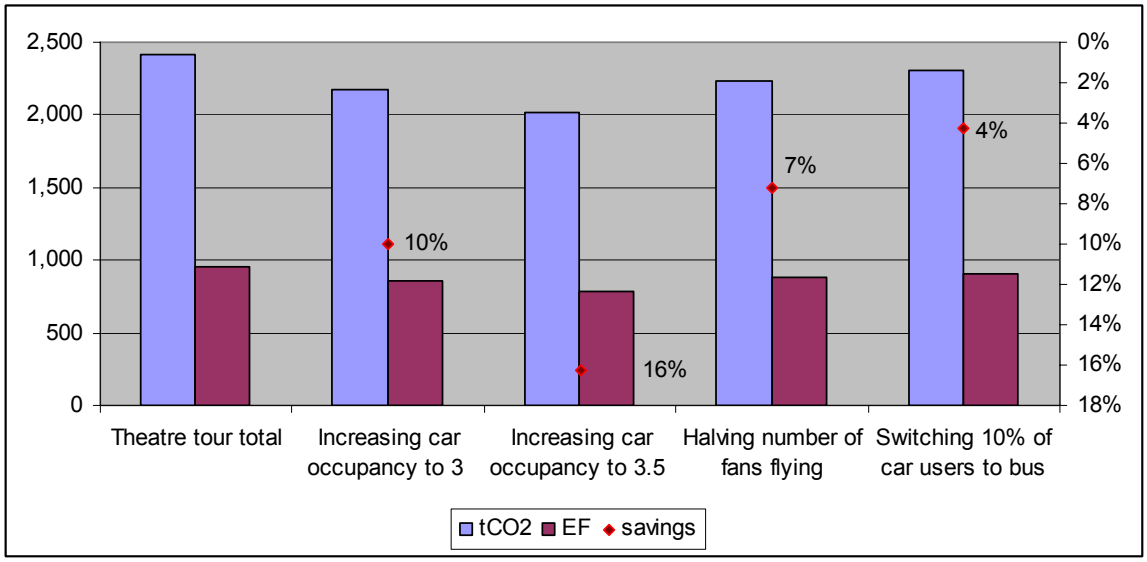
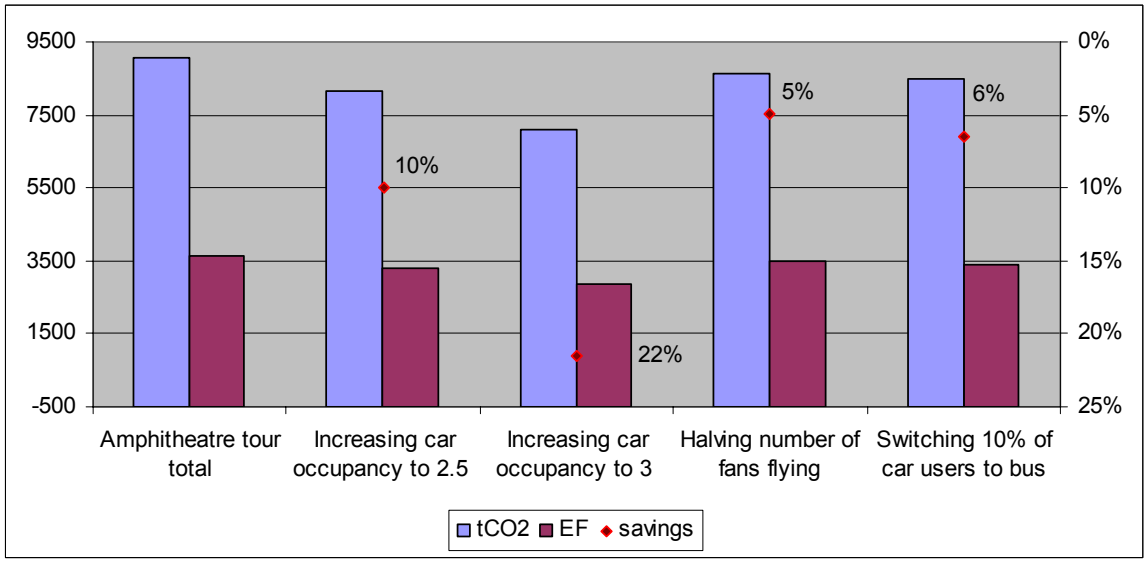


Figure 11.4 – Savings from scenarios for the Amphitheatre tour



Catering & Merchandise

Catering and merchandise are responsible for 4-6% of fan impacts

This section covers t-shirts sold and catering provided at venues. Data for numbers of t-shirts sold were available, but all data for catering has been based on anecdotal evidence from RY and BFF. As both beer and food have major impacts and are proportional to the number of fans, it is recommended that this should be further investigated to get more accurate information.

Catering quantities assumed per person:

Theatre tour:	Two beers and one bottle of water.
	Waste: two bottles, two plastic glasses, one plastic bottle.
Amphitheatre tour:	Two beers and three bottles of water, plus a large serving of either burger & chips or nachos & cheese.
	Waste: two bottles, two plastic glasses, three plastic bottles, paper plate.

Catering typically provides fast food with a lot of packaging. This study conservatively assumes that food is packed in paper or cardboard. If the packaging is polystyrene instead, the waste impacts would increase by 5%. All waste is assumed to be landfilled.

Figure 12.1 – Ecological Footprint and CO_2 emissions for merchandise and catering for the 2006 Theatre tour

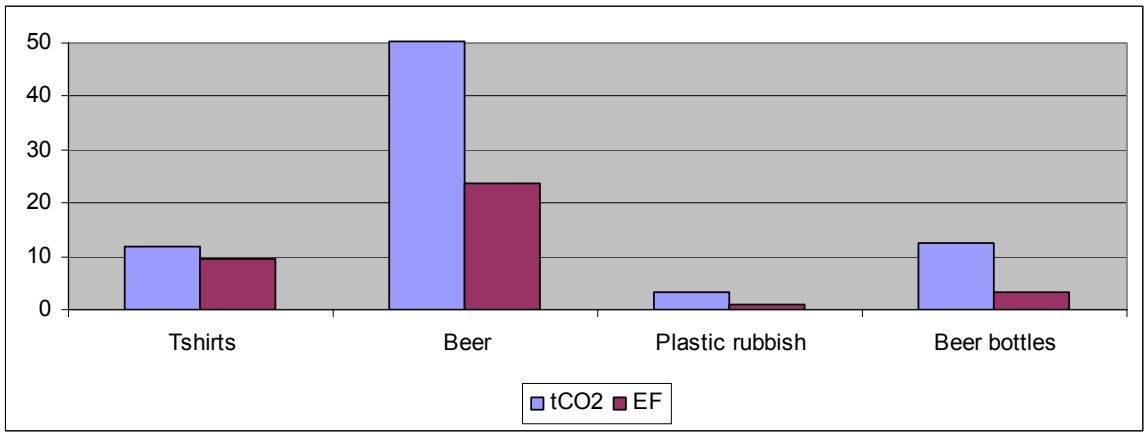
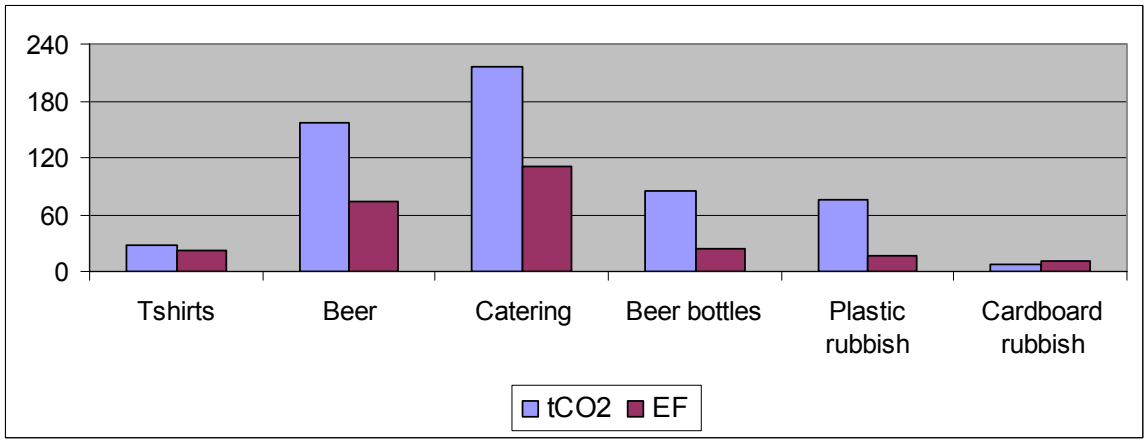


Figure 12.2 – Ecological Footprint and CO_2 emissions for merchandise and catering for the 2003 Amphitheatre tour

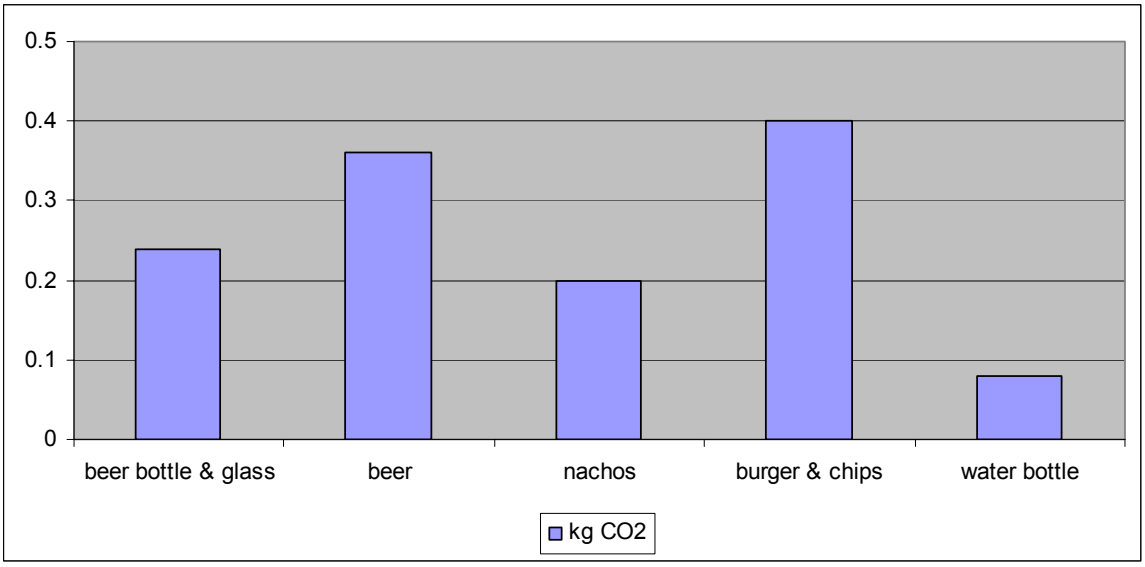


Possibilities for reduction

Glass bottles, plastic bottles and glasses are the main impacts of waste. Recycling glass reduces the impact by about 10%, and recycling plastic reduces impact by about 20%, so reduction of waste offers the best opportunity for reducing impacts. Plastic water bottles could be replaced by a free water supply in large open-air arenas, with fans encouraged to bring their own refillable containers. Plastic beer glasses could be dispensed with. Well-marked recycling bins make responsible disposal simpler. For catering, meat products are higher impact than non-meat: figure 12.3 shows that burger & chips have twice the impact of nachos.

All these measures are dependent on the co-operation of the venues and would become easier to implement if other bands also asked for the same conditions at their concerts, to establish a more sustainable norm.

Figure 12.3 –Catering: impact per unit



Opportunities for Reduction

When considering what action to take to reduce the Ecological Footprint and CO_2 emissions of Radiohead tours, it is important to take two factors into account: the scale of each individual impact, and how much influence Radiohead has over that impact. Of course it is important to focus on the practices with the largest environmental effects, but attention should also be given to how easy those practices are to change. An action plan to tackle these issues would need to be developed in conjunction with the staff who would be responsible for putting it into practice

Any action plan to reduce Ecological Footprint and CO_2 emissions from Radiohead tours will need reliable data collection to allow progress to be monitored. The most important areas to focus on will be fan travel and the venues' catering, waste disposal and energy use. The current study had no solid data for these.

Festivals instead of tours

For festivals, fan travel is likely to be even greater than for a concert (one review of Bonnaroo 2006 opens *'Wow, you drove all the way from Canada!?'* i.e. maybe 1200km if from Toronto or 4000km if from Vancouver). Anecdotal experience of UK festivals suggests that the catering and waste at festivals are likely to be very high impact as people are buying all their food there, and creating and leaving a lot of rubbish.

80,000 people attended Bonnaroo 2006, so the audience at this one festival was bigger than 19 Theatre tour concerts, and about the same as three large arena Amphitheatre tour gigs. The total fan impact is shared between many bands – 87 on the Bonnaroo 2006 lineup – so although the impact may be much more per fan, it will work out much less per band.

If considering playing at several festivals in a season, the main consideration will be the distance between venues and the mode of travel. As is shown in the band travel section, trucks and coaches produce about half of the band's impacts and this is directly related to the distance they travel. If several bands shared the festival sound and lighting kit, this would eliminate most of the trucking, leaving only band, a possibly smaller crew, and the personal kit to be transported (hoping to leave the heavy flight cases in storage).

Band Impacts

The two high-impact areas most amenable to reduction are in US travel and international freight. A small but easy win is gained from switching the rehearsal space to a 100% green electricity tariff[11].

US travel

- Using a chartered train instead of trucks and coaches would reduce travel impacts by about 95%, though would potentially introduce other problems, security and loading for example. Using coaches for personal transport and rail for freight would save about 80%.
- Avoiding chartered flights would have saved about 35% of the travel impact on the Theatre tour.
- There might be scope for using more fuel-efficient trucks and coaches, or for loading them more intensively and using less vehicles. Each truck less would have saved 5% of the band's impacts and 17% of the travel impacts. Avoid biofuels (unless they are made from reused chip fat).

[11] But note that only three UK electricity suppliers – Good Energy, Ecotricity and Green Energy UK – supply renewables at a level significantly higher than the minimum threshold required under the Renewables Obligation. See also www.est.org.ukH

International Freight
Shipping freight requires more time and planning, so would mean adapting touring schedules to allow for the uncertainties of sea traffic. Possibly some of the core kit could be duplicated so that it was not all required at all tours.

- Shipping freight from the UK to the US and back would save 95% compared to the air-freight emissions.
- Trucking back from US west coast to east coast and shipping to the UK from there, as was done after the Theatre tour, saves 73% of the emissions.

Fan Impacts

The main impact of Radiohead concerts, by far, is fan travel. Fan behaviour is not in the direct control of the band, but it is felt that they could exert influence both through appeals and through incentives.

This study assumes that the majority of fans travel to concerts by car, mostly with one other person. Fans are probably traveling significant distances from out of town (or for a small number of hardcore fans, from another continent).

Distance
Fan's travel distance might be addressed by staging more concerts in more towns, but it is suspected that the fan base is so keen that they might just drive from town to town to attend more concerts. It may not be possible to stage enough concerts to ensure that everyone has a local concert to attend, and it may not be easy to sell tickets only to locals rather than over the internet. Ticket sales through local box offices might ensure that more local people attended, or might perversely make people travel twice – once to buy tickets at a box office, and again to the concert.

Car occupancy
As can be seen in the Fan Travel section, savings of 10% or even 20% can made by increasing car occupancy, so that most people are traveling with two or more other people. The band could influence car occupancy rates, in conjunction with the venues – perhaps by having cheaper parking for cars with more than two occupants, or by giving some incentive at the venue parking lot – preferential parking, free shuttle bus – these will depend on the venue arrangements.

Switching modes
Switching travel to public transport is problematic and probably unrealistic, as US public transport is poorly provided outside major cities. Siting concerts in city centres without parking facilities could encourage or force people to make part of their journey by public transport or on foot, or buses could be provided from a central pickup point to a venue. A potential problem with both of these strategies is that it might just move the car routes slightly, from driving to the venue to driving to the pickup point instead. However it could be effective to provide buses to venues from university campuses and other concentrated residential centres.

Offsetting

Direct Offsetting

Give each fan a low energy light bulb: each 12W (60W equivalent) saves 48W per hour for an estimated lifetime of 8,000 hours: 384 kWh in total.

Each bulb saves 220 kgCO_2 over its lifetime.

For the Theatre tour, 220kg per fan is more than 15,000 tonnes CO_2 compared to the tour's emissions of 2,300 tonnes. For the Amphitheatre tour, 220kg per fan is 53,000 tonnes CO_2 compared to the tour's emissions of 9,000 tonnes. Even if only one fan in five uses their bulb there is a net saving of CO_2.

Support for such an approach would probably be available from Oxfam and others under 'Stop Climate Chaos' coalition.

Structured Offsetting Schemes

"Offsetting" allows an organisation or individual to demonstrate concern about their carbon emissions by supporting low-carbon projects elsewhere in the world. However, offsets should not be seen as a replacement for CO_2 reduction because:

- the current market price of offsets is far lower than the real costs of CO_2 to the environment, society and the economy (as shown in the Stern Review)
- questions exist over additionality and authenticity of some schemes
- offsetting alone will not create the net overall reduction in CO_2 emissions that we need to avert dangerous climate change.

BFF believe that offsetting should be the last step after taking all possible measures to reduce emissions.

Appendix A: Assumptions and Calculations

Data Collection

Most data were provided by Richard Young (RY) through Courtyard Management, covering details of six shows on the 2006 tour (in theatres), and four shows on the 2003 tour (in large arenas) of North America.

Detailed data were provided for

- Equipment weight and materials
- Band and crew accommodation and travel by air and coach
- Freight movements by air and truck
- Energy consumed by electrical equipment
- Number of fans attending each show
- Merchandise sold.

No solid information was available for venue energy use, venue catering or fan travel.

Data were supplied on spreadsheets "Amphitheatre 1.xls" and "Theatre 1 20070420.xls". Tables of the manipulated data are shown in Appendix B.

Venues

No information was available for the energy used by the venues for heating and lighting, and BFF could not find a way of estimating it, so it has been left as an unknown in the results. However for future studies it is recommended that this should be investigated in more detail.

No information was available about the catering at venues. RY and BFF have made rough estimates of the catering:

- Beer: assumed two x 330ml beers per person
- Food (Amphitheatre tour only): assumed 1.5 x 100g burger and 200g chips for half the audience and 150g nachos with 50g cheese for the remainder
- Water: assumed one 500 ml bottle per person for the Theatre tour and three bottles for the Amphitheatre tour
- Waste: assumed two 230g beer bottles, two 20g plastic glasses, one 20g plastic water bottle, 18g cardboard food packaging per person.

Travel

Fan travel

Rough estimates have been made by RY and BFF of

- Fan travelling distances
- Fan modes of transport

RY supplied an estimate of the profile of travel mode – for example, 1% flying, 60% driving to Theatre concerts, 83% driving to Amphitheatre concerts. Flights are estimated using US average domestic flight length[12] – 1390km. Driving distances were estimated as a standard 200km.

Estimating these figures introduces a large uncertainty – did they drink one or two bottles of beer? did they drive 100 or 500 km? Because they are estimated per person, the results have a very wide range when scaled up to total audience figures.
For future studies it is recommended that this should be investigated in more detail, perhaps through fan surveys motivated by a prize draw, or data collected directly at venues.

[12] US Bureau of Transportation Statistics (BTS) www.bts.govH

Truck and coach travel
Truck fuel consumption and generator figures were supplied by the truck hire company (through RY). Coach fuel consumption has been assumed to be the US long-distance coach average[13] with a 20% loading to cover generator fuel.

Road distances were taken from http://www.mapquest.com where not supplied, and flying distances were taken from http://www.csgnetwork.com/airportdistance.html (for North America) and www.webflyer.com (international).

Conversion factors for petrol and diesel CO_2 emissions were taken from DEFRA[14] for the UK and BTS[15] for the US travel.

Equipment

The impacts of the sound, lighting and video equipment were estimated based on two months out of its expected lifetime (five years for electronics and plastic, fifteen years for wood and steel components). The metal component of the set was assumed to be steel.

Expanding from sample show data

Detailed data was supplied for six shows on the 2006 Theatre tour, and four shows on the 2003 Amphitheatre tour.

Figures for the impacts per show – energy use, fan travel and catering, merchandise – were expanded to represent the whole tour by number of shows: 2006 figures were divided by 6 and multiplied by 19, 2003 figures were divided by 4 and multiplied by 12. Total truck and coach distances were based on distances between the real show locations.

The fixed impacts – international travel, equipment and rehearsals – were added to the expanded figures to give a "total tour" figure for each tour. The total tour figures were used to derive "per show" and "per fan" statistics.

[13] US Bureau of Transportation Statistics (BTS) www.bts.govH

[14] *Guidelines for Company Reporting on Greenhouse Gas Emissions* DEFRA, July 2005

[15] US Bureau of Transportation Statistics (BTS) www.bts.govH

Appendix B: Data Tables

Summary	Theatre tour		Amphitheatre tour	
	tCO_2	EF	tCO_2	EF
Rehearsal, pre-production, US set-up	23	7	40	14
International travel	106	42	123	56
Equipment - whole tour	3	1	12	4
Travel & energy for all shows	184	70	125	47
Merchandise & catering for all shows	78	37	570	258
Fans Travel	1900	744	8202	3277
Total	**2,295**	**902**	**9073**	**3655**

Travel & energy for all shows		Theatre tour			Amphitheatre tour		
	Units		tCO_2	EF		tCO_2	EF
Chartered planes	veh-km	4,138	64.2	26.0			
Band hotel	nights	155	5.3	1.5	84	2.9	0.8
Crew hotel	nights	722	13.9	3.9	93	1.8	0.5
Tour coach	veh-km	14,377	25.2	10.0	24,347	31.3	12.4
US taxis, runner van	veh-km	6,603	2.1	0.9			
Trucks	veh-km	17,100	62.4	24.6	30,434	73.2	28.9
Equipment power	kWh	23,513	10.8	3.1	28,076	16.1	4.6
Smoke	litre	38	0.2	0.0	24	0.1	0.0
Total			**184.1**	**69.9**		**125.2**	**47.1**

International travel		Theatre tour			Amphitheatre tour		
	Units		tCO_2	EF		tCO_2	EF
UK-US air travel	pass-km	151,640	31.7	10.7	159,570	33.4	11.3
US-UK return flight	pass-km	227,500	47.5	16.1	207,630	43.4	14.7
UK-US air freight	tonne-km	34,080	19.4	12.5	35,460	20.2	13.0
US-UK return air/sea freight	tonne-km	52,500	7.5	3.1	46,140	26.3	16.9
Total			**106.2**	**42.4**		**123.3**	**55.8**

Rehearsal, pre-production, US set-up		Theatre tour			Amphitheatre tour		
	Units		tCO_2	EF		tCO_2	EF
UK car travel	veh-km	912	0.2	0.1			
UK freight	km	100	0.0	0.0			
UK Electricity	kWh	24,129	11.4	3.5			
US Electricity	kWh				25,100	14.4	4.1
trucks to 1st show	veh-km	4,000	7.4	2.7	3,500	19.4	7.7
US crew air travel	pass-km	6,967	2.0	0.7	7,700	2.2	0.7
Band hotel	nights				14	0.5	0.1
Crew hotel	nights	102	2.0	0.5	161	3.1	0.9
Smoke	litre	20	0.1	0.0	20	0.1	0.0
Total			**23.0**	**7.5**		**39.7**	**13.5**

Equipment - whole tour		Theatre tour			Amphitheatre tour		
	Units		tCO_2	EF		tCO_2	EF
Electronics	kg	116.7	1.0	0.3	500	4.2	1.1
Sound & lighting - plastic	kg	16.7	0.0	0.0	33	0.1	0.0
Sound & lighting - steel	kg	55.6	0.1	0.0	111	0.2	0.1
Sound & lighting - wood	kg	278	0.1	0.3	478	0.2	0.5
Set - plastic	kg	400	1.1	0.3			
Set -steel	kg	500	0.9	0.2	4,000	7.3	2.0
Total			**3.3**	**1.2**		**12.0**	**3.7**

Fans Travel		Theatre tour			Amphitheatre tour		
	Units		tCO_2	EF		tCO_2	EF
Ten Japanese fans	pass-km	218,000	45.6	15.4	218,000	45.6	15.4
Fan car	veh-km	4,060,423	1299.8	530.5	22,402,305	7171.2	2926.7
Fan flying	pass-km	1,312,264	374.0	126.5	3,348725	954.4	322.8
Fan bus	veh-km	566,373	15.1	6.0	1,156248	30.8	12.2
Fan train	veh-km	1,510,328	165.7	65.6			
Fan walk	pass-km	2,832	0.0	0.0			
Total			**1900.1**	**743.9**		**8202.0**	**3277.1**

Merchandise & catering for all shows		Theatre tour			Amphitheatre tour		
	Units		tCO_2	EF		tCO_2	EF
Tshirts	kg	1732	11.7	9.6	4177	28.3	23.1
Beer	kg	46181	50.3	23.5	144531	157.5	73.6
Plastic rubbish	kg	4198	3.3	0.9	24089	75.7	16.5
Beer bottles	kg	32187	12.4	3.4	110807	85.3	23.3
Catering	kg				97558	215.4	110.2
Cardboard rubbish	kg				4336	8.0	11.2
Total			77.8	37.4		**570.2**	**257.9**

Appendix C: What is Ecological Footprint analysis?

Co-originated in the early 1990's by Professor William Rees and Dr. Mathis Wackernagel, Ecological Footprint analysis has rapidly taken hold and is now in common use in many countries at national and local levels; for example, the UK, Mexico, the United States, Canada, Holland, Denmark, Sweden, Norway, Italy, Spain and Australia. The Ecological Footprint of a region or community can be said to be the bioproductive area (land and sea) that would be required to sustainably maintain current consumption, using prevailing technology. More recently Ecological Footprint studies of organisations and processes have become more popular indicators of sustainability.

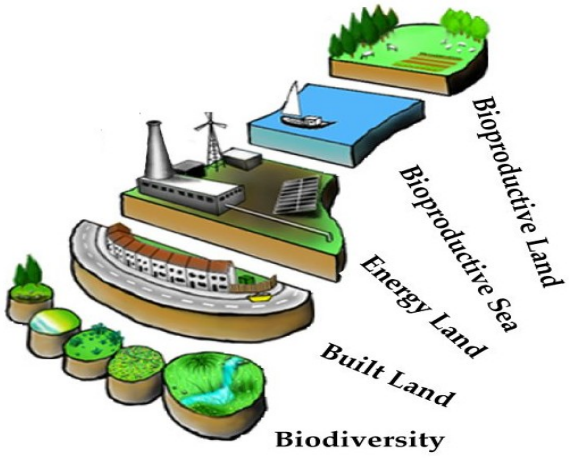
Take only pictures - leave only footprints

It is important to note that Ecological Footprint analysis is a 'snapshot' methodology. It tells us how much bioproductive area would be required based on a specific data set - it does not attempt to predict future or past impacts.

It is likely that, due to technology changes and variations in material flows into the economy, the Ecological Footprint will change over time. In the period which data is recorded some of the input flow of materials will stay in the organisation, as stock, and some will flow out as waste. In both cases these materials were considered to have been 'consumed'.

For the purposes of the Ecological Footprint calculation, land and sea area are divided into four basic types; bioproductive land, bioproductive sea, energy land (forested land and sea area required for the absorption of carbon emissions) and built land (buildings, roads etc.). A fifth type refers to the area of land and water that would need to be set aside to preserve biodiversity (see Figure A1).

Figure A1 – Land types used for Ecological Footprint analysis



Example 1: A cooked meal of fish and rice would require bioproductive land for the rice, bioproductive sea for the fish, and forested 'energy' land to re-absorb the carbon emitted during the processing and cooking.

Example 2: Driving a car requires built land for roads, parking, and so on, as well as a large amount of forested 'energy' land to re-absorb the carbon emissions from petrol use. In addition, energy and materials are used for construction and maintenance.

The Stepwise™ methodology

The Corporate Stepwise™ Ecological Footprint calculations in this report follow the Stepwise™ methodology. The methodology, developed by Best Foot Forward (see Chambers *et al*, 2000), uses a 'component' (or 'bottom-up') approach to perform Ecological Footprint analysis. Though different data sources are used, the calculation method is wholly compatible with the 'compound' (or 'top-down') approach used by Wackernagel *et al.* in the *Footprint of Nations* studies (1997, 1999, 2000 and 2002), which use international trade statistics as a starting point.

The Stepwise™ methodology, wherever possible, uses full life cycle impact data to derive Ecological Footprint conversion factors for key activities (the 'components'). For example, to calculate the Ecological Footprint of a car passenger travelling one kilometre, fuel use, materials and energy for manufacture and maintenance of the vehicle, and the share of UK roadspace appropriated by the car are accounted for (Figure A2). This conversion factor is then applied to the number of passenger-kilometres travelled.

Figure A2 – An example analysis for the Ecological Footprint of UK car travel (per passenger-km)

Component	Inputs	CO_2 emissions	Built land	Footprint
Petrol	0.094 litres	0.22 kg		0.000031[ii] area unit-yrs
Maintenance & Manufacture	0.0423 litres equivalent	0.10 kg		0.000014[iii] area unit-yrs
Road Space	258,175 ha		[a] 817,043 area units (1)	
Car Road Share	[b] 86%			
Car $_{km}$	[c] 362,400,000,000			
Average Occupancy	[d]1.6 persons			
Calculation			(a+b)/c/d	i+ii+iii
Footprint			0.0000012[i] area unit-yrs	0.000046 area unit-yrs/pass-km

A similar approach is used to derive a range of Ecological Footprint component values, representing the main categories of impact, before summing them to calculate a total Ecological Footprint. The key components used in this study are:

- Direct energy
- Materials & waste
- Transport
- Water

Each of these key components is made up of smaller sub-categories. For example, 'direct energy' is sub-divided into electricity, gas and heating oil. Each of these sub-categories can be broken down further.

Using this component approach enables the calculation of Ecological Footprints at any level – for a product, organisation, activity or region.