



BEST FOOT FORWARD

Bringing sustainability down to earth

Carbon Footprinting for:

RAIL▶EUROPE™

White paper

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Best Foot Forward

One of Europe's leading sustainability consultancies, Best Foot Forward (BFF) specialises in ecological and carbon footprint analysis offering consulting services, training and management tools.

Founded in 1997, BFF is widely credited with popularising the footprint concept in the UK following the award-winning *Island State* study of the Isle of Wight's economy, a guide on footprinting businesses, produced for the Association of Chartered and Certified Accountants, and the publication, in 2000, of *Sharing Nature's Interest: ecological footprints as an indicator of sustainability*.

BFF's mission statement is to 'help organisations, regions and communities to reduce their footprint'.

Best Foot Forward have unrivalled experience and an enviable track record having helped over one hundred organisations and undertaken in excess of 300 footprint studies.

The company has advised on everything from reducing the supply chain impacts associated with African apple production and distribution to managing Greater London's ecological footprint.

Best Foot Forward's multinational team of analysts and consultants are based in Oxford, England. The company is also able to draw on a network of global partners and associates offering local knowledge, where appropriate, and additional sectoral expertise when required.

In 2005, Best Foot Forward were conferred the prestigious Queen's Award for Enterprise in Sustainable Development. This 'corporate knighthood' specifically recognised their contribution to corporate sustainability.



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1. Introduction

Rail Europe Ltd has commissioned this study to assess the carbon footprint associated with a passenger travelling from London to 50 destinations using three different transport modes namely, train, car and aeroplane.

This White Paper describes the methodology used in the calculations and the associated assumptions. A list of carbon emission factors and sources used is also presented in the following section.

2. Methodology and assumptions

In order to estimate emissions for each route and transport mode, several steps had to be followed:

- Description of the route: origin and destination of each leg of the trip, including intermediate locations for train journeys, and mode of transport used.
- Distances associated with each leg of the trip
- Conversion factors associated with the modes of transport used

Carbon emissions associated with each route are calculated by multiplying the estimated distances by the relevant conversion factor. Results calculated in this study refer to a one way trip.

All distances have been calculated from London to the final destination following the route described by Rail Europe.

2.1 Distances

Some distances were provided by Rail Europe. Where distances were not available, the following method has been followed:

Car distances

Distances associated with car travel have been estimated using Google Maps first suggested route. From the same source, the Eurotunnel is estimated to have a length of 59 km.

A list of car distances used in the study can be found in Appendix A.

Plane distances

Flight distances have been estimated using Web Flyer website¹ from the relevant London Airport to the main Airport indicated in the Rail Europe provided route.

A list of plane distances used in the study can be found in Appendix A.

Train distances

Train distances have been calculated using Google Maps, replicating the train route distances in the map. To aid the details of the train routes, the DB Bahn website² has been consulted. This method

¹ <http://webflyer.com>

² www.bahn.com

may involve a small overestimation in some instances since the source used calculates travel distances by road.

Journeys have been separated between countries in order to apply the specific conversion factor of the national average train in each country.

A list of train distances used in the study can be found in Appendix A.

Bus distances

In some cases, plane and train transport modes to the destination involve the use of buses. Bus distances have been estimated using Google Maps.

A list of bus distances used in the study can be found in Appendix A.

Paris underground distances

The shortest underground route has been selected. To estimate the total distance travelled on the underground the number of stations on each line has been multiplied by the average interstation distance of the line³.

A list of Paris underground distances used in the study can be found in Appendix A.

2.2 Conversion factors

The list of conversion factors and sources used in this study are shown in the following table:

Transport mode	Source
Bus	Defra 2010; Coach, direct emissions
Car-per passenger ⁴	Based on Defra 2010, UK average car (unknown fuel), direct emissions
Paris underground	Based on factors for metropolitan Swiss train Ecolnvent 2.2, and adjusted for France using electricity consumption and associated emissions from both countries
Madrid underground	As above, adjusted for Spain
Rome underground	As above, adjusted for Italy
Plane	Ecolnvent 2.2; aircraft in Europe, direct emissions
Eurostar	Based on Eurostar reported CO ₂ emissions ⁵ . CO ₂ e has been estimated using an uplift estimation based on Ecolnvent average French train (direct emissions)
Eurotunnel	Assumed same emissions per passenger as Eurostar
French train	Ecolnvent 2.2; average train, France, direct emissions
Italian train	Ecolnvent 2.2; average train, Italy, direct emissions
Spanish train	Ecolnvent 2.2; based on average train from Swiss average train. Adjusted for Spain using electricity consumption and associated emissions from both countries
Swiss train	Ecolnvent 2.2; average train, Switzerland, direct emissions
Austrian train	Ecolnvent 2.2 ; average train, Austria, direct emissions
Belgian and Dutch trains	Ecolnvent 2.2 ; average train, Belgium, direct emissions

³ www.stif.info

⁴ It assumes car occupancy of 2 people.

⁵ www.eurostar.com

Danish train	EcolInvent 2.2; based on average train from Swiss average train. Adjusted for Denmark using electricity consumption and associated emissions from both countries
German train	As above, adjusted for Germany
UK train	Defra 2010; National rail, direct emissions

All conversion factors units refer to CO₂e emissions per passenger kilometre (CO₂e/pkm). Note that car emissions assume a car occupancy of 2 passengers.

Appendix A: Estimated distances

The following tables show the distances used for skiing and city destinations:

Table A. 1: Distances (skiing destinations)

Transport mode	Origin	Destination	Distance (km)
bus	Annecy	La Clusaz	32
bus	Bourg-Saint-Maurice	Les Arcs	15
bus	Bourg-St-Maurice	Val D'isere	30
bus	Briancon	Serre Chevalier	16
bus	Chambery	Brides-Les-Bains	90
bus	Chambery Airport	Courchevel	103
bus	Chambery Airport	La Plagne	112
bus	Chambery Airport	Les Arcs	70
bus	Chambery Airport	Meribel	103
bus	Chambery Airport	Val D'isere	144
bus	Chambery Airport	Val Thorens	112
bus	Chatillon	Cervinia	25
bus	Embrun	Les Orres	13
bus	Geneva	Chamonix	80
bus	Geneva	La Clusaz	50
bus	Geneva Airport	Megeve	70
bus	Girona	Soldeu	271
bus	Grenoble Station	Grenoble	2
bus	Innsbruck	Ischgl	100
bus	L'hospitalet	Soldeu	189
bus	Landeck	Ischgl	30
bus	Moutiers-Salins-Brides-Les-Bains	Brides-Les-Bains	8
bus	Moutiers-Salins-Brides-Les-Bains	Courchevel	25
bus	Moutiers-Salins-Brides-Les-Bains	Meribel	18
bus	Moutiers-Salins-Brides-Les-Bains	Val Thorens	35
bus	Oulx	Montgenevre	20
bus	Oulx	Sauze D'oulx	6
bus	Turin	Oulx	79
bus	Turin	Puy St Vincent	130
bus	Turin	Serre Chevalier	125
bus	Turin Airport	Turin	19
car	London	Chambery	995
car	London	Cervinia	1,053
car	London	Chamonix	949
car	London	Courchevel	1,005
car	London	Ischgl	1,078
car	London	La Clusaz	915
car	London	La Plagne	1,024
car	London	Les Arcs	1,049
car	London	Les Orres	1,094
car	London	Megeve	934
car	London	Meribel	924
car	London	Oulx	1,060
car	London	Puy St Vincent	1,097
car	London	Sauze D'oulx	1,047

car	London	Serre Chevalier	1,087
car	London	Soldeu	1,179
car	London	St Anton Am Alberg	1,044
car	London	Engadin St Moritz	1,095
car	London	Val D'isere	1,048
car	London	Val Thorens	1,027
metro	Paris Nord	Paris Bercy	10
metro	Paris Nord	Paris Austerlitz	6
metro	Paris Nord	Paris Lyon	6
metro	Paris Nord	Paris Est	1
plane	London Gatwick Airport	Geneva Airport	715
plane	London Gatwick Airport	Girona Airport	1,050
plane	London City Airport	Chambery Airport	758
plane	London City Airport	Zurich Airport	753
plane	London Gatwick Airport	Turin Caselle Airport	880
plane	London Gatwick Airport	Grenoble Airport	761
plane	London Gatwick Airport	Turin Airport	880
plane	London Heathrow Airport	Innsbruck Airport	972
Eurostar	London St Pancras	Paris Nord	495
Eurotunnel	Folkestone	Frethun	59
train	London St Pancras	Paris Nord	495
train	Paris	Lyon	450
train	Lyon	Moutiers-Salins-Brides-Les-Bains	182
train	Paris Lyon	Turin	762
train	Turin	Chatillon	90
train	Turin Caselle Airport	Turin Porta Nuova	30
train	Turin Porta Nuova	Chatillon	90
train	Paris Austerlitz	Chamonix	615
train	Paris	Zurich	775
train	Zurich	Landeck	200
train	Paris Lyon	Annecy	550
train	Paris Nord	Aime-La-Plagne	660
train	Paris Nord	Bourg-St-Maurice	690
train	Paris	Grenoble	590
train	Grenoble	Embrun	135
train	Paris	Sallanches-Combloux-Megeve	629
train	Paris	Oulx	684
train	Grenoble	L'Argentiere	133
train	Grenoble	Briancon	118
train	Paris Austerlitz	L'Hospitalet	1,090
train	Zurich	St Anton am Alberg	170
train	Innsbruck	St Anton am Alberg	100
train	Zurich	Chur	119
train	Chur	St Moritz	86
train	Paris Nord	Bourg-St-Maurice	640

Table A. 2: Distances (city destinations)

Transport mode	Origin	Destination	Distance (km)
bus	Avignon Airport	Avignon	6
bus	Barcelona Airport	Barcelona	18
bus	Bordeaux Airport	Bordeaux	11
bus	Florence Airport	Florence	13
bus	Lille Airport	Lille	12
bus	Luxembourg Airport	Luxembourg	6
bus	Perpignan Airport	Perpignan	6
bus	Venice Airport	Venice	13
car	London	Amsterdam	479
car	London	Angouleme	847
car	London	Bordeaux	979
car	London	Bruges	228
car	London	Brussels	310
car	London	Cologne	530
car	London	Copenhagen	1,172
car	London	Dijon	682
car	London	Florence	1,522
car	London	Geneva	931
car	London	Ghent	260
car	London	Lille	223
car	London	Luxembourg	529
car	London	Lyon	873
car	London	Madrid	1,665
car	London	Malaga	2,219
car	London	Marseille	1,182
car	London	Milan	1,205
car	London	Nice	1,338
car	London	Paris	405
car	London	Perpignan	1,245
car	London	Pisa	1,467
car	London	Poitiers	733
car	London	Reims	379
car	London	Rome	1,791
car	London	Strasbourg	730
car	London	Venice	1,470
car	London	Vienna	1,419
Eurostar	London	Brussels	373
Eurostar	London	Paris Nord	495
Eurostar	London	Lille	290
Eurotunnel	Folkestone	Frethun	59
underground	Rome Airport	Rome	16
underground	Madrid Airport	Madrid	15
underground	Paris Nord	Paris Bercy	10
underground	Paris Nord	Paris Austerlitz	6
underground	Paris Nord	Paris Lyon	6
underground	Paris Nord	Paris Est	1
plane	London City Airport	Amsterdam Schiphol Airport	336

plane	Southampton Airport	Avignon Airport	913
plane	London Stansted Airport	Barcelona Airport	1,180
plane	London Gatwick Airport	Bordeaux Airport	703
plane	London City Airport	Brussels Airport	317
plane	London Heathrow Airport	Cologne Airport	531
plane	London City Airport	Copenhagen Airport	948
plane	London Heathrow Airport	Geneva Airport	753
plane	London City Airport	Florence Airport	1,190
plane	London City Airport	Geneva Airport	735
plane	London City Airport	Brussels Airport	317
plane	London Gatwick Airport	Lille Airport	237
plane	London City Airport	Luxembourg Airport	483
plane	London City Airport	Madrid Airport	1,260
plane	London Gatwick Airport	Malaga Airport	1,640
plane	London Gatwick Airport	Marseille Provence Airport	958
plane	London City Airport	Milan Airport	950
plane	London City Airport	Nice Airport	1,020
plane	London City Airport	Paris Charles De Gaulle Airport	330
plane	London Stansted Airport	Perpignan Airport	1,030
plane	London Stansted Airport	Pisa Airport	1,180
plane	London Stansted Airport	Poitiers Airport	589
plane	London Stansted Airport	Paris Charles De Gaulle Airport	359
plane	London Gatwick Airport	Rome Airport	1,410
plane	London City Airport	Strasbourg Airport	634
plane	London Gatwick Airport	Venice Airport	1,120
plane	London Heathrow Airport	Vienna Airport	1,270
train	Amsterdam Schiphol Airport	Amsterdam	18
train	Bordeaux	Angouleme	119
train	Brussels	Amsterdam	212
train	Brussels	Bruges	100
train	Brussels	Cologne	238
train	Brussels	Cologne - Copenhagen	1,150
train	Brussels	Ghent	56
train	Brussels	Luxembourg	257
train	Brussels	Frankfurt-Austria	1,330
train	Brussels Airport	Bruges	110
train	Brussels Airport	Brussels	14
train	Cologne Airport	Cologne	16
train	Copenhagen Airport	Copenhagen	9
train	Geneva	Dijon	269
train	Geneva Airport	Geneva	6
train	Lille	Angouleme	736
train	Lille	Avignon	965
train	Lille	Bordeaux	855
train	Lille	Lyon	655
train	Lille	Marseille	1,063
train	Lille	Paris Nord	205
train	Lille	Poitiers	621
tram	Lille Airport	Lille	13
train	London	Southampton	80
train	Madrid	Malaga	513
train	Malaga Airport	Malaga	13
train	Marseille Provence Airport	Marseille	26
train	Milan Airport	Milan	49

train	Nice Airport	Nice	7
train	Paris	Florence	1,259
train	Paris	Geneva	558
train	Paris	Madrid	1,459
train	Paris	Milan	884
train	Paris	Nice	1,005
train	Paris	Florence-Pisa	1,367
train	Paris	Rome	1,544
train	Paris	Venice	1,207
train	Paris	Perpignan	922
train	Paris Austerlitz	Barcelona	1,129
train	Paris Bercy	Dijon	342
train	Paris Charles De Gaulle	Paris	26
train	Paris Charles De Gaulle	Reims	150
train	Paris Est	Reims	146
train	Paris Est	Strasbourg	489
train	Pisa Airport	Pisa	4
train	Poitiers Airport	Poitiers	5
train	Strasbourg Airport	Strasbourg	13
train	Vienna Airport	Vienna	22