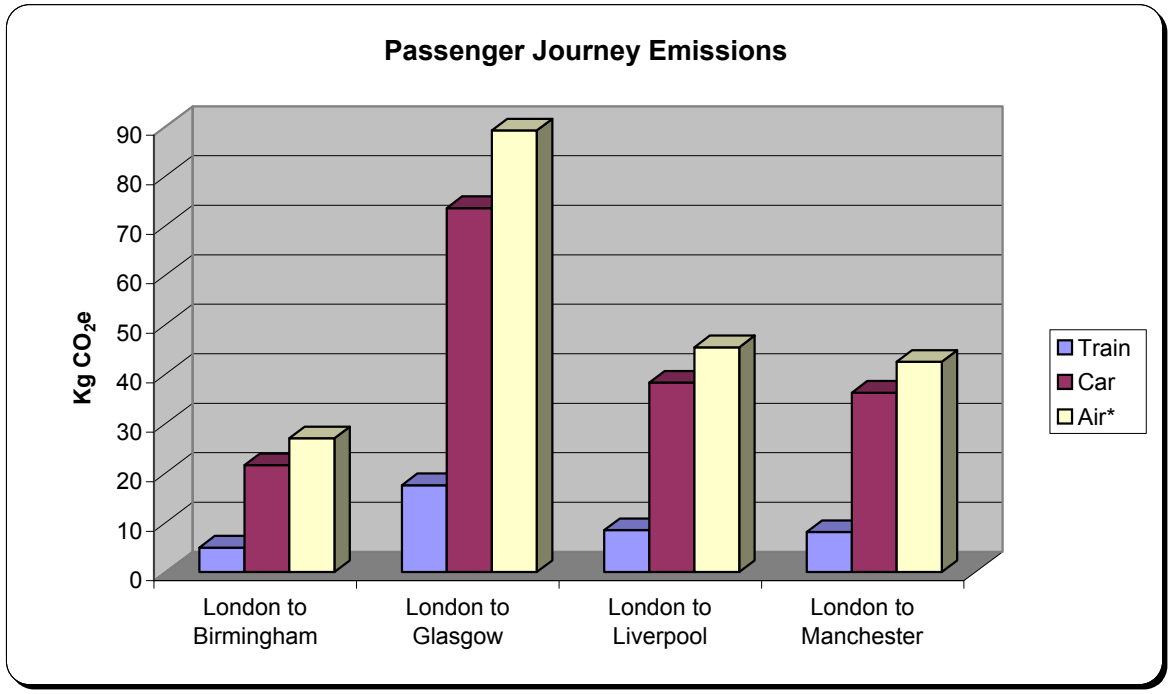
VIRGIN TRAINS EMISSIONS COMPARISON

SUMMARY

	Emissions ($kgCO_2e$/journey)		
	Train	Car	Air*
London to Birmingham	4.9	21.6	27.0
London to Glasgow	17.6	73.6	89.2
London to Liverpool	8.5	38.3	45.4
London to Manchester	8.1	36.2	42.5

*Flights are between major airports, not city centres



A. VIRGIN WEST COAST TRAIN

Source of emissions	Journey distance (km)	CO_2 emitted per passenger (kg)
London Euston to Birmingham New Street	*181.9*	4.9
London Euston to Glasgow Central	*645.7*	17.6
London Euston to Liverpool Lime Street	*311.4*	8.5
London Euston to Manchester Piccadilly	*296.5*	8.1

Notes

Data collection period: Passenger loading: 10th September 2006 to 14th October 2006

Data in italics were provided by Virgin

Assumptions

Assume energy consumption per train km is standard for all Virgin West Coast services

Energy consumption of a Class 390 Virgin Pendolino service travelling between London Euston and Manchester Piccadilly:	*4,200*	kWh
Distance London Euston to Manchester Piccadilly:	*296.5*	km
Energy consumption per train kilometer:	14.17	kWh/km (derived from above)
Seats per train:	*439*	
Average loading of an intercity UK train:	*51%*	
Average number of passengers per train:	224	(derived from above)
Energy consumption per passenger:	0.063	kWh/pass.km (derived from above)
CO_2 emissions for electricity:	0.43	kg/kWh (Defra 2005)
CO_2 emissions per passenger kilometer:	0.0272	$kgCO_2$/pass.km (derived from above)

B. PETROL CAR

Source of emissions	Journey distance (km)	CO_2 emitted per passenger (kg)
London Euston to Birmingham New Street	191	21.6
London Euston to Glasgow Central	650	73.6
London Euston to Liverpool Lime Street	338	38.3
London Euston to Manchester Piccadilly	320	36.2

Notes
Data in italics were provided by Virgin

Assumptions

All distances calculated using the AA's route finder (www.theaa.com)
Assume vehicles are average petrol cars
Average car occupancy: 1.59 passengers (DfT 2006)
CO_2 emissions for an average petrol car: 0.18 $kgCO_2/km$ (Defra 2005)

C. AIR

Source of emissions	Journey distance (km)	CO_2 emitted per passenger (kg)
London Gatwick to Birmingham	180	27.0
London Gatwick to Glasgow	595	89.2
London Gatwick to Liverpool	303	45.4
London Gatwick to Manchester	283	42.5

Notes
Data in italics were provided by Virgin

Assumptions

All distances calculated between London Gatwick and each city's major airport using Air Routing International's distance calculator (www.airrouting.com)
Assume flights are from London Gatwick
CO_2 emissions for short-haul flights: 0.15 $kgCO_2$/pass.km (Defra 2005)
Please note:
Journeys are between airports not city centres

REFERENCES

The AA Online route planner www.theaa.com
Air Routing International Online flight/distance calculator www.airrouting.com
Defra 2005 Guidelines for the measurement and reporting of emissions trading in the UK Emission Trading Scheme. Department for Environment, Food and Rural Affairs, London
DfT 2006 Transport Trends. The Department for Transport www.dft.gov.uk