VTrans 2035

SAFE • STRATEGIC • SEAMLESS

Virginia's Long-Range Multimodal Transportation Plan

2007-2035

EUROPEAN LESSONS LEARNED

Prepared for:

Office of Intermodal Planning and Investment

August, 2009

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EUROPEAN LESSONS FOR VIRGINIA

VTrans2035 includes a range of policy papers which discuss particular key issues that Virginia faces, identify trends, identify what is being done, and discuss opportunities for new or enhanced initiatives. The papers also identify potential approaches taken by other states that might be worthy of consideration.

This paper on potential European lessons is much more speculative in terms of its potential applicability to Virginia. This is because this paper is about ideas and policies and outcomes which may represent quite a stretch for Virginia to consider. Despite its many similarities in terms of its economic aspects and its democratic governments, Europe is different. The lessons of this paper are thus informative but they may be about approaches which have not yet been tried in Virginia or in other states.

By "Europe", we mean for discussion purposes primarily the traditional western European democracies ranging from Ireland and the United Kingdom to Scandinavia to Italy to the Iberian peninsula of Spain and Portugal. These nations and the United States have comparable economic prosperity and democratic institutions. Potential lessons from the former Soviet bloc nations are not discussed here, because those societies were and still are much too different from our own context. In addition to Europe, some statistics are also presented for Canada and Australia. These two very large and very sparsely populated countries are also similar to the U.S. in terms of economic and democratic contexts.

OVERALL EUROPEAN LESSONS

Professor Antoine Hobeika of Virginia Tech provides comparisons of the primary differences between U.S. and European cities based on when the city originally developed, what the overall comparison shows, and the differences in roadway and automobile transportation. ("*A Comparison of U.S. and European Approaches to Multimodal Passenger Transportation planning and Design*" Antoine G. Hobeika, September 12, 2007).

- Few U.S. cities developed before 1830 during the "walking city" era, whereas European cities all developed as walking cities before 1830;
- The U.S. cities have high auto ownership and dependence on private cars with shares of 95 percent of trips, decentralized land uses, and lower densities, whereas European cities have lower auto ownership and use and lower dependence on private cars, more compact development, and more integrated multimodal systems;
- The U.S. has lower roadway-user taxes, lower miles per gallon (mpg) for personal vehicles, and higher standards for criteria pollution controls, whereas Europe has high roadway user charges and mpg and less strict regulations on the criteria pollutants.

MOBILITY AND ENERGY EUROPEAN LESSONS

A primary difference between the U.S. and Europe is in vehicle travel per capita and transportation energy consumption. The U.S. vehicle fleet uses much more energy per mile of travel than the vehicle fleets of other major countries. This is largely due to different national policies. For example, European countries have set very high motor fuel prices and also follow other policies to encourage fuel efficiency, such as graduated taxes on engine sizes. The Appendix illustrates vehicle policies in European countries.

European countries and other advanced industrial nations have historically followed other consistent policies which have resulted in lower energy consumption and lower GHG emissions than in the U.S. The primary differences include vehicle fuel efficiency rules, earlier development of cities at higher densities, more historical investment in passenger rail and urban transit, and energy pricing policies which put high taxes on fuel. These policies in Europe have led to or have contributed to:

(1) passenger vehicles with better fuel efficiency;

(2) less travel in terms of distance per year per vehicle or per driver;

(3) more reliance on other modes or on non-motorized travel; and

(4) more compact development which is consistent with shorter vehicle trips and with more use of public transportation modes and of non-motorized transportation.

European Vehicle Miles and Transportation Energy Per Person

Table 1, compiled by the Victoria Policy Institute from OECD data, shows the per capita vehicle kilometers of travel in European nations, Japan, and Canada in comparison to the United States, and also the estimated transportation energy consumption per capita. In all instances, the per capita vehicle travel and per capita transportation energy usage are lower in the European countries and Canada. Per capita vehicle travel is 40 to 70 percent of U.S. per capita vehicle travel. Japan and Greece are very low outliers, due probably to very high densities in Japan and lower incomes in Greece than the other countries in the table.

The per capita transportation energy consumption in many European nations is one half or less the per capita transportation energy consumption in the U.S. For most European countries, the per capita energy consumption is lower in comparison to the U.S. than is the per capita travel, which is generally a result of the higher fuel consumption rates of the U.S. fleet compared to those nations. The EU as a whole is ahead of the U.S. by 60 to 80 percent in fuel efficiency, and aspires to further improvements in fleet average fuel consumption.

Europe has more availability of and more use of public transportation than the U.S., but passenger travel is still mostly by private auto and from 1995 to 2005 private auto use increased by 18 percent. For the original fifteen European Union members, rail travel grew by 17 percent in this period, and bus travel by 10 percent. In the newer 12 EU member states, rail passenger travel decreased 49 percent and bus travel decreased by 11 percent during this period, which is when these mostly newly free or newly emerging economies began to westernize and develop. Car ownership in Europe reached 460 per 1,000 persons in 2005, with most of the more westernized nations above this level, in comparison to 777 per 1,000 persons in the U.S. Table 1, compiled by the Victoria Policy Institute from OECD data, shows the annual vehicle kilometers per capita and the annual transportation energy per capita for the U.S. and European countries.

Table 1 Annual Vehicle Kilometers of Travel Per Capita and Transportation Energy Per Capita Relative to the United States

	Vehicle Travel Per Capita Annual KMT	Relative to US	Energy Per Capita Annual Tonnes	Relative to US
Belgium	11,885	51%	1.00	46%
Canada	15,169	66%	1.72	79%
Denmark1	13,058	57%	0.94	43%
France2	12,977	56%	0.91	42%
Finland	12,865	56%	0.88	40%
Germany	10,186	44%	0.78	36%
Greece	3,812	17%	0.73	33%
Iceland	16,217	70%	1.14	52%
Italy	15,453	67%	0.77	35%
Japan	6,602	29%	0.73	34%
Netherlands	9,961	43%	0.93	43%
Norway	12,301	53%	1.05	48%
Portugal	9,180	40%	0.70	32%
Spain	9,270	40%	0.90	41%
Sweden	11,619	50%	0.94	43%
Switzerland	12,409	54%	0.96	44%
United Kingdom	11,614	50%	0.90	41%
United States3	23,095	100%	2.18	100%

References
1. OECD in Figures – 2005 edition
2. OECD Factbook 2006: Economic, Environmental and Social Statistics
Source: Victoria Policy Institute, compiled from OECD data 2005 (1) and 2006 (2) and U.S.

European Fuel Taxes

European gasoline taxes range from $1.75 per gallon to $3.78 per gallon, and are much higher than the fuel taxes in the United States. Table 2 shows European fuel taxes and U.S. fuel taxes in 2007, each expressed in both Euros per 1,000 liters and in dollars per gallon. As is apparent, all European fuel taxes are substantially higher than U.S. fuel taxes, although there are significant variations. Also, many of the European countries tax diesel fuel at lower rates than they tax gasoline, although their diesel taxes are still much higher than U.S. diesel taxes.

Table 2 European and U.S. Fuel Taxes 2007

Country	Gasoline Euros Per 1,000 Liters	Gasoline Dollars Per Gallon	Diesel Euros Per 1,000 Liters	Diesel Dollars Per Gallon
Austria	447	$2.37	347	$1.84
Belgium	592	$3.14	331	$1.75
Denmark	655	$3.47	470	$2.49
France	607	$3.22	428	$2.27
Finland	588	$3.12	319	$1.69
Germany	537	$2.85	364	$1.93
Greece	331	$1.75	276	$1.46
Ireland	443	$2.35	368	$1.96
Italy	564	$2.99	423	$2.24
Luxembourg	462	$2,45	290	$1.54
Netherlands	679	$3.60	371	$1.97
Portugal	583	$3.09	364	$1.93
Spain	396	$2.10	302	$1.60
Sweden	371	$1.97	399	$2.11
United Kingdom	713	$3.78	713	$3.78
United States	72	$.38	85	$.45

Sources: European Road Federation, Highway Statistics
Conversion rates: One gallon equals 3.7854 liters; One Euro equals $1.40 (June, 2009)

Europe does not consider that it has done everything that it could do to reduce fuel consumption and greenhouse gas emissions in the transportation sector. Transportation greenhouse gas emissions in Europe increased by 27 percent from 1990 to 2005 according to the European Environment Agency (EEA). The EEA also recognizes that not enough has been done in EU countries, particularly on the demand side, despite their currently lower levels of transport emissions than in the U.S. In recent years the EU's reductions in transportation greenhouse gas emissions have lagged far behind the EU's GHG emissions reductions in other sectors. Europe reduced its greenhouse gas emissions from 1990 to 2005 except for the transport sector. If the transport sector had achieved the same reductions as other European sectors, total EU greenhouse gas emissions would have decreased by 14 percent instead of by 8 percent.

The EEA's 2007 Report "*Climate for a Transport Change*" states, with regard to the highest 2020 emissions reduction target, which was set in the Bali Roadmap,

"Present knowledge indicates that it will not be possible to achieve ambitious targets comparable to the Bali roadmap without limiting transport demand." The EEA report lists potential additional strategies such as behavioral measures (such as ecodriving) within each mode, limits on increases in transport volumes, shifts among modes, construction and maintenance of infrastructure, and pricing. Ecodriving is driving so as to minimize fuel use and is advocated and taught in many European countries.

EUROPEAN PASSENGER RAIL AND TRANSIT LESSONS

In European nations, passenger travel is primarily by passenger car, but there is much greater use of other modes. Table 3 shows the breakouts of passenger travel in European nations for selected modes including passenger cars, buses urban rail (trams and metros) and railways. The European breakout for railways includes what we normally identify as two categories: intercity rail and commuter rail. The data includes only motorized modes but does not show two wheeled vehicles, which range from 0.1 percent to 0.9 percent of passenger miles.

European nations rely on passenger cars for from a low of 68.9 percent of passenger miles in Belgium to a high of 86.5 percent of passenger miles, in the United Kingdom, compared to 96.2 percent in the U.S. Another interesting aspect of the European data is the high percentage of bus passenger miles in many European nations, serving from 5.2 percent to 24.7 percent of passenger miles in each nation, although we tend to think of their rail services as being very notable. The comparable figure for all bus passenger miles in the U.S. is 3.2 percent. European railways serve from 4.4 percent to 9.8 percent of passenger miles, except in Greece, which clearly has less rail usage than the other European countries. This data includes both extensive commuter rail systems and extensive intercity rail systems. The urban rail systems, including trams and metros, serve only from 0.0 to 4.1 percent of passenger miles, although only one nation (Luxembourg at 0.0) is below the U.S. in terms of percentage of passenger miles served by urban rail.

Table 3 European and U.S. Percentages of Passenger Miles 2006

Country	Percentage Passenger Cars	Percentage Bus	Percentage Urban Rail	Percentage Railways
Austria	75.7	9.8	4.1	9.8
Belgium	68.9	24.7	1.1	5.3
Denmark	83.9	6.4	1.5	7.6
France	83.9	5.2	1.5	9.1
Finland	84.1	10.1	0.7	4.8
Germany	79.5	11.0	0.3	9.0
Greece	77.5	18.8	1.3	1.6
Ireland	75.9	18.7	0.3	5.1
Italy	80.7	12.0	0.7	5.4
Luxembourg	85.1	10.5	0.0	3.9
Netherlands	83.5	6.8	0.8	8.3
Portugal	81.3	12.5	1.1	4.4
Spain	80.7	11.7	1.5	5.2
Sweden	82.2	7.4	1.9	8.1
United Kingdom	86.5	6.3	1.1	5.9
United States	96.2	3.2	0.3	0.3

Sources: European Road Federation, U.S. National Surface Transportation Policy and Revenue Study Commission; for U.S. figures, intercity rail (0.1) and commuter rail (0.2) were added to get total rail, and transit bus (0.5), intercity bus (0.4), and school and other bus (2.3) were added to get bus totals.

One lesson from Europe is something about which not very much can be done: Europe had very significant and large historical investments in commuter rail and public transportation which shaped its cities, as did some U.S. cities such as New York. The relatively high usage of rail and public transportation in Europe is due to historical development patterns and due to those historical investments, which would be enormously expensive to duplicate. Our analyses of national transit investment needs for other projects has illustrated that a doubling of public transportation ridership over the next twenty years would require several times as much capital investment in public transportation and railways as is occurring now. Such an investment, at the end of the twenty years, would still leave us far short of the current levels of public transportation usage in Europe.

The U.S. is only now beginning to give significant attention to investments in intercity rail and high speed intercity rail. There are many corridors identified in the National Transportation Policy and Revenue study Commission Report ("Transportation for Tomorrow", December 2007), including both north and south from Richmond and a potential east-west corridor through Virginia. The Commission recommended a national capital investment level of $7 billion per year in intercity rail, compared to about $1 billion per year today.

The Commonwealth is already utilizing its available resources and polices to foster greatly improved public transportation, but the "lesson" is that even a doubling or more of investments still will leave us well short of current levels of European public transportation and rail usage.

NON-MOTORIZED TRANSPORTATION EUROPEAN LESSONS

European countries do not regularly collect data on walking and bicycling, but some individual nations have data. In the Netherlands, cycling increased by 10 percent from 2002 to 2005, to an average of 2.5 kilometers per day, but in the United Kingdom, cycling reportedly declined by 16 percent in this period. Data for the year 2000 for some European countries showed enormous variations in cycling experience, ranging from 936 and 838 km per year in Denmark and the Netherlands to 23 and 20 km per year in Luxembourg and Spain. Such disparities between adjacent countries such as Luxembourg and the Netherlands illustrate that there are enormous cultural differences among the countries of Europe.

LAND USE EUROPEAN LESSONS

Although the European cities start out with higher densities and with less auto dependence, their policy approaches are remarkably similar. The EU's land use policies suggested include these, which are already very familiar to Virginia:

- Increasing densities to increase the viability of local services that are accessible on foot or by bicycle, as well as increasing the viability of public transport;
- Changing the mix and layout of development components to deliver local services and employment opportunities;

- Concentrating dense development within transport corridors;
- Reducing parking space as a trip-end restraint;
- Requiring developer contributions to transport infrastructure and including provision of public transport services as part of the planning process;
- Requiring payments from commuters to aid delivery of public car parks or park-and-ride schemes;
- Adopting measures such as travel plans to reduce car use; and
- Locating development close to nodes accessible to public transport.

ECONOMIC DEVELOPMENT EUROPEAN LESSONS

Europe and particularly the United Kingdom are now the leaders in developing and applying programs to improve both the environment and the economy. The UK Ministry of Transport has adopted policies designed to make transportation investments which both enhance the economy and reduce GHG emissions, and has established multimodal economic benefit-cost and environmental analysis procedures to guide their investments.

From the United Kingdom, the *Eddington Transport Study: The Case for Action: Sir Rod Eddington's Advice to Government*, December 2006 provides the most profoundly important lessons for VTrans2035 and Virginia on the role of transportation in a modern economy. The lessons include both the underlying mechanisms through which transportation investments enhance the economy but also a ground breaking elaboration of the full overall impacts of including all economic and climate change factors in the economic evaluation of multimodal transportation projects.

The Eddington report's seven micro-economic driver mechanisms through which transport investment drives economic performance are highly relevant lessons for VTrans2035 and are summarized as:

- Increasing business efficiency through time savings and improved reliability for business travelers, freight, and logistic operations;
- Increasing business investment and innovation by supporting economies of scale or new ways of working;
- Supporting clusters and agglomerations of economic activity;
- Improving the efficient functioning of labor markets, increasing labor market flexibility and the accessibility of jobs;
- Increasing competition by opening up access to new markets;
- Increasing domestic and international trade by reducing the costs of trading; and

- Attracting globally mobile activity (to the UK) by providing an attractive business environment and good quality of life.

Another major contribution of the Eddington report is its elaboration of the types of economic measures that can be calculated, Eddington evaluates three types of overall measures:

- The conventional benefit-cost ratio which refers to the measure conventionally used;
- The wider benefit-cost measure which would add on to traditional b/c the "missing" gross domestic product (GDP) impacts identified above; and
- The value for money (vfm) assessment which adds in the missing GDP impacts plus the monetized estimate of the environmental and some social costs.

Sir Eddington concludes that the last and broadest measure is the most appropriate to use in evaluating transportation investments. He provides a summary of the results of using these methodologies to evaluate a wide range of projects across modes and across purposes. He finds that "urban network projects" have benefit-cost ratios averaging over 3.0, international gateways projects have benefit-cost ratios averaging about 6.0, and inter-urban corridor projects have benefit-cost ratios averaging just below 2.0. While these results are for the United Kingdom, they may be indicative of the kinds of returns on investment which are available from these types of projects in the Commonwealth, and provide valuable lessons.

SAFETY EUROPEAN LESSONS

Perhaps in no other area are the lessons from European experience as difficult for us to view as in safety. Highway safety in the U.S. has been improving on a per capita or per vehicle mile basis, but at a lower rate since 1990 than improvements in Europe. In addition, after, 2000, the U.S. rates of fatalities tended to stabilize while most European rates of fatalities continued to get better. If the U.S. had kept pace with safety improvements of other societies, the fatality rate would be lower than it is today.

Table 4 shows European versus U.S. road fatality rates from 1990 to 2004, and the percentage change in road fatality rates over that period for each country. The U.S. is at the low end in terms of percentage improvements from 1990 to 2004. Of greater concern, some nations made dramatic improvements after 2000, while the U.S. fatality rate stabilized and stopped improving rapidly. In addition, by 2004, the U.S. had the highest rate of road fatalities per person, partly due to higher levels of travel per person as shown in table 1. However, each of the other countries was growing just as fast or faster than the U.S. in terms of the numbers of vehicles per capita.

Germany, New Zealand, and Switzerland each showed declines in road fatality rates per capita of over 50 percent. Of particular concern is the trend data from Australia and Canada rather than the trend data from Europe. Australia and Canada have extensive rural areas and extensive long distance travel, as does the U.S. Their percentage reductions in fatalities per capita were 37 percent and 42 percent respectively between 1990 and 2004, whereas the U.S. reduction was 23 percent. Only Japan, Italy, and Iceland showed lower percentage improvements than the U.S. over the period.

The safety lessons that could be learned from these other nations should be integrated with the domestic lessons learned from other states as they proceed to implement and enhance their SHSPs. European nations have placed emphasis on comprehensive approaches to reducing fatalities, as states are now doing in their State Highway Safety Plans (SHSPs). The experience of the other nations as well as the emerging experience of Virginia and other states with their SHSPs indicate that substantial further improvements to safety can be successfully implemented.

Table 4 Annual National Road Fatalities Per Million Population

Country	Rate 1990	Rate 2000	Rate 2004	Percent Change 1990 to 2004
Australia	137	95	86	37%
Austria	200	122	108	46%
Belgium	199	143	109	45%
Canada	150	95	87	42%
Denmark[1]	123	93	74	40%
France[2]	182	129	92	49%
Finland	130	76	72	45%
Germany	176	91	71	60%
Greece	195	193	135	31%
Iceland	96	113	79	17%
Ireland	139	110	95	31%
Italy	115	115	103	10%
Japan	90	82	75	17%
Luxembourg	185	172	109	41%
Netherlands	92	68	49	46%
New Zealand	217	121	99	54%
Norway	91	76	56	38%
Portugal	234	186	124	47%
Spain	179	143	115	36%
Sweden	90	67	53	41%
Switzerland	141	82	69	51%
Turkey	125	58	80	36%
United Kingdom	94	59	57	40%
United States[3]	188	149	145	23%
Source: OECD Factbook				

CONGESTION AND PRICING EUROPEAN LESSONS

As anyone who has driven in European cities knows very well, congestion in Europe is at least as much a problem as it is in cities in the U.S. To some extent, the congestion experienced in European cities is a product of overlaying an automobile culture on top of cities which developed long before the automobile. Except for attempts, as in France, to build extremely expensive vehicle tunnels in cities such as Paris, the provision of large amounts of new road capacity in such high density cities cannot be accomplished without damage to their historical character or to the urban qualities which Europeans value. So, high levels of congestion may be destined to remain.

Short of providing new roadways through the cities, one option that has been tried in a few European cities is pricing to reduce vehicle travel to central areas. London and Norwegian cities have instituted cordon pricing which has resulted in some reductions of travel to central areas, with consequent reductions in congestion for the remaining vehicle users within those central areas.

Virginia's approach to integrate pricing as an element of its management of transportation performance has been its initiatives in utilizing high occupancy toll lanes, which are about to be implemented in two major projects in Northern Virginia. VDOT and DRPT have already performed comprehensive analyses of the potential impacts of these applications, and it is not certain that the experiences of Europe with pricing of central areas add lessons for Virginia's upcoming pricing applications.

PRESERVATION EUROPEAN LESSONS

A continuous series of scans of European preservation and contracting practices has now been conducted by FHWA, TRB, and AASHTO for decades. The scans have served to keep the U.S. preservation and contracting community up to date on European developments. In Europe, both materials and contracting have been researched thoroughly and the lessons have been compiled by U.S. researchers and professionals involved in the scans. One recent scan team's findings included the observation that "concrete pavements in the countries visited are designed for 30 or more years of low-maintenance service life. The countries are responding to pavement-tire noise issues in urban areas by using exposed aggregate surface. Some use catalog designs for pavements and geotextiles as a separator layer between the cement-treated base and concrete pavement."

The scan team's recommendations for U.S. implementation included using two-lift construction to build pavements, developing pavement design catalogs, using better-quality materials in pavement sub bases, paying greater attention to cement and concrete mixture properties, using a geotextile interlayer to prevent concrete slabs from bonding to the cement-treated base, and using exposed aggregate surfaces to reduce noise." (Report No.: FHWA-PL-07-027, "*Long-Life Concrete Pavements in Europe and Canada*", August 2007, Author(s): Kathleen Hall, Dan Dawood, Suneel Vanikar, Robert Tally, Jr., Tom Cackler, Angel Correa, Peter Deem, James Duit, Georgene Geary, Andrew Gisi, Amir Hanna, Steven Kosmatka, Robert Rasmussen, Shiraz Tayabji, and Gerald Voigt)

Virginia and other states have participated in exchanging the information about lessons from Europe as well as lessons from other states. In particular, Virginia is a very early adapter to utilizing European and other lessons about contracting, with its comprehensive approach to contracting out Interstate preservation and maintenance.

FREIGHT EUROPEAN LESSONS

In the area of freight, there are some not very positive lessons from Europe. Europe did not develop an extensive multinational freight rail system commensurate with its total size, due perhaps to the history of warfare and security concerns. Today, Europe relies on trucking and waterways for internal freight shipments. The growth of trucking has been dramatic until the most recent years, due partly to the reduction of trade barriers and to the greater integration of the overall European economy. Without a solid continental freight rail system, trucking has absorbed the dominant share of internal growth in freight. The EEA's report notes that truck travel grew faster (30 percent) than the overall economy (24.5 percent) from 1995 to 2005, with consequences for both congestion and for overall energy use by European freight modes. Road freight increased by 38 percent during this period, rail freight by 8 percent, and inland waterways by 9 percent.

Appendix: European Vehicle Engine Displacement and Emission Fees

This is a particularly interesting topic because it is entirely unknown to the U.S. public and decision makers. For the past decade, it has been the policy of the European Commission to realign transportation prices in order to reflect the costs of externalities associated with transportation.[1] The reductions in atmospheric emissions set forth through EURO I to V (European emission standards) concern four main pollutants: carbon monoxide (CO), oxides of nitrogen (NOx), particles, and hydrocarbons. In regards carbon dioxide (CO2), the "Community objective" is to achieve an average emission level from new vehicles of 120 g CO2/km. Europe has a three-pronged approach in this connection:

- Voluntary commitments by the automobile industry under which European (ACEA), Japanese (JAMA) and Korean (KAMA) car makers have undertaken to reduce average emissions from new vehicles by 25% between 1995 and 2008-2009 (from 186 g CO2/km in 1995 to 140 g CO2/km in 2008-2009). Compliance with these commitments is the subject of annual reports by the Commission.
- Better information for consumers on fuel consumption and CO2 emissions
- Introduction of fiscal measures to promote the purchase of less polluting vehicles.[2]

Various fiscal measures, such as taxes on engine displacement in cubic centimetres, and fuel consumption taxes, have been implemented in European countries with the intention of charging modes of transportation according to the marginal social cost of their use of the infrastructure, including environmental costs.[3] Using this method, it is possible to make users bear certain environmental costs resulting from their use of transportation. As of February 2008, 14 European Union Member States levy passenger taxes that are totally or partially based on the car's CO2 emissions and/or fuel consumption. The table below provides an overview of these taxes.[4]

COUNTRY	CO2/FUEL CONSUMPTION TAXES
AUSTRIA	A fuel consumption tax (Normverbrauchsabsage or NoVA) is levied upon the first registration of a passenger car. It is calculated as follows: - Gasoline cars: 2% of the purchase price x (fuel consumption in liters – 3 liters) - Diesel cars: 2% of the purchase price x (fuel consumption in liters –

[1]http://eea.eionet.europa.eu/Public/irc/eionet-circle/transub/library?l=/misc/externalities_24-10-05do/_EN_1.0_&a=d
[2]http://europa.eu/scadplus/leg/en/lvb/l28165.htm
[3]http://www.direct.gov.uk/en/Motoring/OwningAVehicle/HowToTaxYourVehicle/DG_10012524
[4]http://www.acea.be/images/uploads/files/20080302_CO%202%20tax%20overview.pdf

	2 liters) Under a bonus-malus system starting on 1 July 2008, cars emitting less than 120g/km receive a maximum bonus of EURO (€) 300. Cars emitting more than 180g/km pay a penalty of € 25 for each gram emitted in excess of 180g/km. (160 g/km as from 1 January 2010). Alternative fuel vehicles attract a bonus of maximum € 500.
BELGIUM	1. Tax incentives are granted to private persons purchasing a car that emits less than 115g CO2 /km. The incentives consist of a reduction of the invoice price with the following amount: - Cars emitting less than 105g/km: 15% of the purchase price, with a maximum of € 4,350 - Cars emitting between 105 and 115 g/km: 3% of the purchase price, with a maximum of € 810 2. The company car tax is based on CO2 emissions. 3. The deductibility of expenses related to the use of the car (60 to 90%) is linked to CO 2 emissions. 4. The Walloon Region operates a bonus-malus system whereby new cars emitting 145 g/km or less obtain a bonus (maximum € 1,000 for cars below 105g/km) and cars emitting more than 195 g/km pay a penalty (maximum € 1,000 for cars emitting more than 255 g/km).
CYPRUS	1. The rates of the registration tax (based on engine capacity) are adjusted in accordance with the vehicle's CO2 emissions. This adjustment ranges from a 30% reduction for cars emitting less than 120 g/km to a 20% increase for cars emitting more than 250 g/km. 2. The rates of the annual circulation tax (based on engine capacity) are reduced by 15% for cars emitting less than 150 g/km. 3. A premium of € 683 is granted for the purchase of a new car when its CO2 emissions are below 120 g/km. For the purchase of hybrid and flexible fuel vehicles, the premium amounts to € 1,196.
DENMARK	1. The annual circulation tax is based on fuel consumption. - Gasoline cars: rates vary from 520 Danish Kroner (DKK) for cars driving at least 20 km per liter of fuel to DKK 18,460 for cars driving less than 4.5 km per liter of fuel.

	- Diesel cars: rates vary from DKK 160 for cars driving at least 32.1 km per liter of fuel to DKK 25,060 for cars driving less than 5.1 km per liter of fuel. 2. Registration tax (based on price): An allowance of DKK 4,000 is granted for cars for every kilometer in excess of 16 km (gasoline) respectively 18 km (diesel) they can run on one liter of fuel. A supplement of DKK 1,000 is payable for cars for every kilometer less than 16 km (gasoline) respectively 18 km (diesel) they can run on one liter of fuel.
FINLAND	1. The registration tax is based on CO2 emissions. Rates vary from 10% for cars emitting 60g/km or less to 40% for cars emitting 360g/km or more. The system is fully linear and technologically neutral. 2. The annual circulation tax (currently based on weight) will be based on CO2 emissions from 2010 onwards. Rates will vary from € 20 to € 605 per year.
FRANCE	1. Under a bonus-malus system, a premium is granted for the purchase of a new car when its CO2 emissions are below 130 g/km. The maximum premium is € 5,000 (below 60 g/km). A "super-bonus" of € 300 is granted when a car of at least 15 years old is scrapped simultaneously. A tax is payable for the purchase of a car when its CO2 emissions exceed 160 g/km. The maximum tax amounts to € 2,600 (above 250 g/km). The different thresholds are strengthened by 5g/km every two years. 2. The regional tax on registration certificates ("carte grise") is based on fiscal horsepower, which includes a CO 2 emissions factor. Tax rates vary between € 25 and € 46 per horsepower according to the region. 3. The company car tax is based on CO2 emissions. Tax rates vary from € 2 to € 19 for each gram for cars emitting 100g/km or less to € 19 for each gram emitted for cars emitting more than 250g/km.
GERMANY	The Federal Government has announced its intention to change the basis of the annual circulation tax from cylinder to CO2 emission as from 1 January 2009. The system should be linear. Cars with CO2 emissions below 100 g/km should be exempt.
IRELAND	1. As from 1 July 2008, the registration tax will be based on CO2 emissions. Rates will vary from 14% for cars with CO 2 emissions up to 120 g/km to 36% for cars with CO 2 emissions above 225 g/km. Hybrid

	and flexible fuel vehicles will benefit from an additional tax relief of € 2,500. 2. The annual circulation tax will also be based on CO2 emissions. Rates will vary from € 100 (up to 120 g/km) to € 2,000 (above 225 g/km).
ITALY	A tax incentive of € 800 and a two-year exemption from annual circulation tax is granted for the purchase of a new passenger car complying with the Euro 4 or Euro 5 exhaust emissions standards and emitting not more than 140 g of CO2 /km, provided a Euro 0 or Euro 1 car is scrapped simultaneously. The exemption from annual circulation tax is extended to three years for cars with a cylinder capacity below 1,300.
LUXEMBOURG	The annual circulation tax is based on CO2 emissions. Tax rates are calculated by multiplying the CO2 emissions in g/km with 0.9 for diesel cars and 0.6 for cars using other fuels respectively and with an exponential factor (0.5 below 90 g/km and increased by 0.1 for each additional 10 g of CO2 /km).
THE NETHERLANDS	1. The rate of the registration tax (based on price) is reduced or increased in accordance with the car's fuel efficiency relative to that of other cars of the same size (length x width). The maximum bonus is € 1,400 for cars emitting more than 20% less than the average car of their size; the maximum penalty is € 1,600 for cars emitting more than 30% more than the average car of their size. Hybrid cars benefit from a maximum bonus of € 6,400. Cars emitting more than 232 g/km (gasoline) respectively 192 g/km (diesel) pay an additional tax supplement of € 110 per gram emitted in excess of these thresholds. 2. The annual circulation is reduced by 50% for cars with CO2 emissions up to 110 g/km (gasoline) respectively 95 g/km (diesel).
PORTUGAL	The registration tax is based on engine capacity and CO2 emissions. The CO2 component is calculated as follows: - Gasoline cars emitting less than 120g pay [(€ 5 x g/km) - 475]. Diesel cars emitting less than 100g pay [(€ 15 x g/km) – 1,100] - The highest rates are for gasoline cars emitting more than 210g [(€ 115 x g/km) to 19,285] and for diesel cars emitting more than 180g [(€ 160 x g/km) to 21,190].
SPAIN	The registration tax is based on CO 2 emissions. Rates vary from 0% (below 120 g/km) to 14.75% (above 200 g/km).

SWEDEN	1. The annual circulation tax for cars meeting the Euro 4 exhaust emission standards is based on CO2 emissions. The tax consists of a basic rate (360 Swedish Kroner) plus SEK 15 for each gram of CO2 emitted above 100 g/km. This sum is multiplied by 3.15 for diesel cars registered for the first time in 2008 and by 3.3 for other diesel cars. For alternative fuel vehicles, the tax is SEK 10 for every gram above 100 g/km. 2. A premium of SEK 10,000 is granted for the purchase of "environmentally-friendly cars": - Gasoline/diesel/hybrid cars with CO2 emissions up to 120 g/km - Alternative fuel/flexible fuel cars with a maximum consumption of 9.2 l (gasoline)/8.4 l (diesel)/9.7cm/100 km (CNG, biogas) - Electric cars with a maximum consumption of 37 kwh/100 km
UNITED KINGDOM	1. The annual circulation tax is based on CO2 emissions. Rates range from £ 0 (up to 100 g/km) to £ 300 (gasoline, diesel)/ £285 (alternative fuels) for cars emitting more than 225 g/km. 2. Company car tax rates range from 15% of the car price for cars emitting less than 140 g/km to 35% for cars emitting more than 240 g/km. Diesel cars pay a 3% surcharge.