



	Motor vehicles		Passenger cars		Two-wheelers		Road traffic		Particulate matter concentrations			
	per 1,000 people		per kilometer of road		per 1,000 people		per 1,000 people		million vehicle kilometers		Urban-population-weighted PM10 micrograms per cubic meter	
	1990	2003 ^a	1990	2003 ^a	1990	2003 ^a	1990	2003 ^a	1990	2002		
Afghanistan	3	..	3	..	2	..	..	..	..	..	34	27
Albania	11	70	3	12	2	47	3	1	..	..	93	58
Algeria	55	..	15	..	26	..	..	..	..	..	123	65
Angola	19	..	3	..	14	..	..	..	..	..	142	113
Argentina	181	181	27	37	134	140	1	..	43,119	27,458	105	78
Armenia	5	..	2	..	1	..	2	..	..	316	..	84
Australia	530	..	11	..	450	..	18	18	138,501	..	22	18
Austria	421	545	30	33	387	501	71	73	..	49,800	39	37
Azerbaijan	52	57	7	17	36	45	5	1	..	5,263	..	64
Bangladesh	1	1	0	1	0	0	1	1	..	..	229	157
Belarus	61	168	13	18	59	168	45	51	10,026	5,650	7	9
Belgium	423	527	30	37	385	470	14	31	150,750	156,633	31	28
Benin	3	..	2	..	2	..	34	..	..	..	75	51
Bolivia	41	10	6	1	25	3	9	0	1,139	..	119	92
Bosnia and Herzegovina	114	..	24	..	101	..	..	..	..	..	41	22
Botswana	18	92	3	6	10	38	1	1	..	..	40	25
Brazil	88	170	8	17	84	137	..	28	..	..	41	35
Bulgaria	163	335	39	26	146	295	55	28	..	285	109	69
Burkina Faso	4	..	3	..	2	..	9	..	..	..	140	97
Burundi	..	..	..	..	..	..	..	..	..	..	168	99
Cambodia	..	30	0	31	..	25	9	127	314	7,210	83	51
Cameroon	10	..	3	..	6	..	..	..	..	..	118	86
Canada	605	577	20	34	468	561	12	11	..	..	25	21
Central African Republic	1	..	0	..	1	..	0	..	1,494	..	29	24
Chad	2	..	0	..	1	..	0	..	..	..	103	73
Chile	81	136	13	26	52	89	2	2	..	..	85	56
China	5	15	4	11	1	10	3	46	..	659,390	113 ^b	80 ^b
Hong Kong, China	66	79	253	287	42	59	4	5	8,192	10,781	..	38
Colombia	39	51	13	19	21	43	8	12	50,945	41,587	37	24
Congo, Dem. Rep.	..	..	..	..	..	..	..	..	..	..	70	57
Congo, Rep.	18	..	3	..	12	..	..	..	..	..	126	74
Costa Rica	87	185	7	21	55	103	14	29	..	..	50	40
Côte d'Ivoire	24	..	6	..	15	..	..	..	..	..	94	38
Croatia	..	324	..	50	..	291	..	22	..	18,104	52	35
Cuba	37	..	16	..	18	..	19	..	..	..	43	25
Czech Republic	246	391	46	31	228	358	113	75	37,350	..	70	25
Denmark	368	424	27	32	320	360	9	15	36,304	46,520	29	22
Dominican Republic	75	..	48	..	21	..	..	..	..	..	44	36
Ecuador	35	53	8	16	31	47	2	2	10,306	19,604	37	28
Egypt, Arab Rep.	29	..	33	..	21	..	6	..	..	..	227	136
El Salvador	33	..	14	..	17	..	0	..	2,002	..	46	40
Eritrea	1	..	1	..	1	..	..	..	..	..	178	109
Estonia	211	386	22	9	154	321	66	6	5,455	6,843	18	17
Ethiopia	1	2	2	4	1	1	0	0	..	1,495	175	88
Finland	441	450	29	30	386	433	12	47	39,750	49,790	24	22
France	494	596	32	40	405	495	55	..	422,000	548,900	18	15
Gabon	32	..	4	..	19	..	..	..	..	..	21	13
Gambia, The	13	8	5	3	6	6	..	..	..	..	189	138
Georgia	107	63	27	16	89	50	5	0	4,620	..	204	46
Germany	405	578	53	206	386	545	18	45	446,000	639,100	28	22
Ghana	8	..	4	..	5	..	..	..	..	15,320	39	42
Greece	248	435	22	34	171	331	120	229	..	79,377	70	48
Guatemala	21	57	16	45	11	52	10	12	3,243	4,547	64	76
Guinea	4	..	1	..	2	..	..	..	..	..	87	63
Guinea-Bissau	7	..	2	..	4	..	..	..	..	..	114	84
Haiti	8	..	14	..	5	..	..	..	..	..	69	47

Traffic and congestion

3.12

ENVIRONMENT

	Motor vehicles				Passenger cars		Two-wheelers		Road traffic		Particulate matter concentrations	
	per 1,000 people		per kilometer of road		per 1,000 people		per 1,000 people		million vehicle kilometers		Urban-population-weighted PM10 micrograms per cubic meter	
	1990	2003 ^a	1990	2003 ^a	1990	2003 ^a	1990	2003 ^a	1990	2003 ^a	1990	2002
Honduras	22	61	10	28	5	52	..	14	3,288	..	44	46
Hungary	212	313	21	19	188	274	16	10	22,898	23,260	35	22
India	4	9	2	3	2	6	15	35	..	..	109	84
Indonesia	16	..	10	..	7	..	34	59	..	..	137	114
Iran, Islamic Rep.	34	..	14	..	25	..	36	..	..	..	85	68
Iraq	14	..	6	..	1	..	..	..	..	..	150	167
Ireland	270	447	10	11	227	382	6	9	24,205	33,915	25	20
Israel	210	284	74	110	174	231	8	11	18,212	38,273	70	53
Italy	529	610	99	73	476	545	45	125	344,726	65,983	43	33
Jamaica	52	..	7	..	43	..	..	..	..	..	57	43
Japan	469	582	52	63	283	433	146	105	628,581	790,829	42	33
Jordan	60	99	26	71	44	67	0	0	1,098	526,677	124	69
Kazakhstan	76	96	8	6	50	77	..	5	18,248	4,087	12	27
Kenya	12	11	5	5	10	8	1	1	5,170	..	66	38
Korea, Dem. Rep.	..	..	..	..	..	..	..	..	..	..	203	88
Korea, Rep.	79	304	60	150	48	215	32	36	30,464	..	83	43
Kuwait	474	332	165	..	368	326	..	..	..	..	77	129
Kyrgyz Republic	44	38	10	10	44	38	16	2	5,220	1,992	..	36
Lao PDR	9	..	3	..	6	..	18	..	..	..	35	25
Latvia	135	329	6	11	106	280	76	10	3,932	..	30	17
Lebanon	321	..	183	..	300	..	13	..	..	..	41	43
Lesotho	11	..	4	..	3	..	..	..	445	..	176	94
Liberia	14	..	4	..	7	..	..	..	..	..	57	39
Libya	165	..	10	..	96	..	0	..	..	..	109	121
Lithuania	160	397	12	17	133	364	52	6	..	2,709	28	22
Macedonia, FYR	132	..	30	..	121	..	1	..	3,102	..	36	29
Madagascar	6	..	2	..	4	..	..	..	41,500	..	101	51
Malawi	4	..	4	..	2	..	..	..	..	..	169	88
Malaysia	124	254	26	75	101	222	167	249	..	..	36	28
Mali	3	..	2	..	2	..	..	..	..	..	144	102
Mauritania	10	..	3	..	7	..	..	..	..	..	55	42
Mauritius	59	119	35	72	44	88	54	103	..	78	85	47
Mexico	119	201	41	59	82	133	3	4	55,095	..	70	43
Moldova	53	78	17	26	48	60	45	3	891	678	..	41
Mongolia	21	41	1	2	6	26	22	10	340	2,321	22	16
Morocco	37	45	15	23	28	45	1	1	..	14,242	33	27
Mozambique	4	..	2	..	3	..	..	..	1,889	..	108	44
Myanmar	2	..	3	..	1	..	..	..	..	..	130	75
Namibia	71	82	1	4	39	42	1	2	1,896	..	74	50
Nepal	..	..	..	..	..	..	..	..	..	..	67	43
Netherlands	405	427	58	58	368	383	44	25	90,150	109,955	47	40
New Zealand	524	730	19	31	436	613	24	21	..	..	16	16
Nicaragua	19	39	5	11	10	16	3	8	108	412	49	32
Niger	6	..	4	..	5	..	..	..	178	..	112	86
Nigeria	30	..	21	..	12	..	5	..	..	..	172	95
Norway	458	527	22	26	380	424	48	64	28,136	35,047	26	18
Oman	130	..	9	..	83	..	3	..	..	..	163	124
Pakistan	6	8	4	5	4	7	8	11	25,317	205,385	226	165
Panama	75	107	18	27	60	76	2	..	..	..	58	58
Papua New Guinea	27	..	6	..	7	..	..	..	..	..	12	11
Paraguay	27	88	4	15	16	52	..	..	..	..	109	103
Peru	128	46	43	16	62	30	..	9	..	23,360	98	68
Philippines	10	34	4	13	7	9	6	18	6,189	9,548	55	34
Poland	168	354	18	33	138	294	36	22	59,608	138,100	59	39
Portugal	222	463	34	278	162	429	5	56	28,623	47,943	53	31
Puerto Rico	295	..	79	..	242	..	..	..	..	741,445	70	62



3.12

Traffic and congestion

	Motor vehicles		Passenger cars		Two-wheelers		Road traffic		Particulate matter concentrations			
	per 1,000 people		per kilometer of road		per 1,000 people		per 1,000 people		million vehicle kilometers		Urban-population-weighted PM10 micrograms per cubic meter	
	1990	2003 ^a	1990	2003 ^a	1990	2003 ^a	1990	2003 ^a	1990	2003 ^a	1990	2002
Romania	72	168	11	19	56	144	13	12	23,907	35,675	36	20
Russian Federation	87	174	14	48	65	140	..	43	..	56,455	13	25
Rwanda	2	..	1	..	1	..	..	..	..	..	162	100
Saudi Arabia	165	..	19	..	98	..	0	..	94,141	..	105	91
Senegal	11	14	6	9	8	11	0	0	..	4,013	99	93
Serbia and Montenegro	137	..	31	..	133	..	3	..	..	..	26	17
Sierra Leone	10	4	4	2	7	2	2	0	996	..	101	69
Singapore	130	135	142	111	89	100	40	32	..	16,133	107	48
Slovak Republic	194	286	57	36	163	252	61	9	8,127	10,992	40	20
Slovenia	306	490	42	25	289	446	8	21	5,620	10,261	..	33
Somalia	2	..	1	..	1	..	..	..	..	..	81	35
South Africa	139	144	26	24	97	92	8	4	..	..	34	24
Spain	360	558	43	34	309	455	79	37	100,981	224,370	42	40
Sri Lanka	21	34	4	..	7	13	24	49	3,468	15,630	97	93
Sudan	9	..	22	..	8	..	..	..	..	..	291	219
Swaziland	66	83	18	24	35	40	3	3	..	..	117	71
Sweden	464	504	29	11	426	455	11	24	61,040	58,992	15	14
Switzerland	491	553	46	57	449	511	114	103	48,660	59,052	37	27
Syrian Arab Republic	26	36	10	7	10	12	..	6	..	..	151	89
Tajikistan	3	..	1	..	0	..	..	..	..	1,092	..	57
Tanzania	5	..	2	..	1	..	..	..	..	..	57	38
Thailand	46	..	36	..	14	..	86	..	45,769	..	87	77
Togo	24	..	11	..	16	..	8	..	..	..	50	45
Trinidad and Tobago	117	..	19	..	98	..	..	..	..	..	124	22
Tunisia	48	88	19	43	23	60	..	1	..	19,231	71	46
Turkey	50	90	8	101	34	66	10	15	27,041	52,344	76	56
Turkmenistan	..	..	..	..	..	..	..	..	..	..	..	73
Uganda	2	5	..	4	1	2	0	3	..	..	60	33
Ukraine	63	137	20	39	63	114	59	28	59,500	13,755	45	29
United Arab Emirates	121	..	52	..	97	..	..	..	..	..	233	109
United Kingdom	400	442	64	42	341	439	14	19	399,000	484,722	25	17
United States	758	808	30	36	573	482	17	17	2,527,441	4,208,594	30	24
Uruguay	138	..	45	..	122	..	74	..	..	..	235	154
Uzbekistan	..	..	..	..	..	..	..	..	..	..	95	81
Venezuela, RB	93	..	25	..	73	..	..	..	563	..	22	12
Vietnam	..	..	..	..	..	..	45	..	..	..	127	66
West Bank and Gaza	..	..	..	..	..	..	..	..	..	..	..	..
Yemen, Rep.	34	..	8	..	14	..	..	..	8,681	..	..	82
Zambia	14	..	3	..	8	..	..	..	..	..	133	71
Zimbabwe	32	50	4	7	29	44	33	4	..	..	60	43
World	118 w	141 w	..	..	91 w	100 w	..	..	..	..	77 w	60 w
Low income	5	8	..	..	3	6	..	..	..	..	129	89
Middle income	37	69	..	..	24	51	..	..	..	..	79	62
Lower middle income	22	39	..	..	10	29	..	..	..	..	92	70
Upper middle income	121	187	..	..	91	143	..	..	..	..	50	40
Low & middle income	25	47	..	..	16	35	..	..	..	..	93	70
East Asia & Pacific	9	20	..	..	4	14	..	..	..	..	112	80
Europe & Central Asia	97	170	..	..	79	142	..	..	..	..	39	35
Latin America & Carib.	100	153	..	..	72	108	..	..	..	..	60	43
Middle East & N. Africa	36	..	..	..	24	..	..	..	..	..	126	89
South Asia	4	10	..	..	2	6	..	..	..	..	131	99
Sub-Saharan Africa	21	..	..	..	15	..	..	..	..	..	114	73
High income	499	623	..	..	390	433	..	..	..	..	37	29
Europe EMU	429	570	..	..	379	502	..	..	..	..	33	27

a. Data are for 2003 or most recent year available. b. Includes data for Hong Kong, China; Macao, China; and Taiwan, China.

About the data

Traffic congestion in urban areas constrains economic productivity, damages people's health, and degrades the quality of their lives. The particulate air pollution emitted by motor vehicles—the dust and soot in exhaust—is proving to be far more damaging to human health than was once believed. (For information on particulate matter and other air pollutants, see table 3.13.)

In recent years ownership of passenger cars has increased, and the expansion of economic activity has led to the transport by road of more goods and services over greater distances (see table 5.8). These developments have increased demand for roads and vehicles, adding to urban congestion, air pollution, health hazards, traffic accidents, and injuries.

Congestion, the most visible cost of expanding vehicle ownership, is reflected in the indicators in the table. Other relevant indicators—such as average vehicle speed in major cities or the cost of traffic congestion, which takes a heavy toll on economic productivity—are not included because data are incomplete or difficult to compare.

The data in the table—except those on fuel prices—are compiled by the International Road Federation (IRF) through questionnaires sent to national organizations. The IRF uses a hierarchy of sources to gather as much information as possible. The primary sources are national road associations. Where such an association lacks data or does not respond, other agencies are contacted, including road directorates, ministries of transport or public works, and central statistical offices. As a result, the compiled data are of uneven quality. The coverage of each indicator

may differ across countries because of differences in definitions. Comparability also is limited when time-series data are reported. Moreover, the data do not capture the quality or age of vehicles or the condition or width of roads. Thus comparisons over time and between countries should be made with caution.

Estimates of particulate matter concentrations weighted by urban population represent the average annual exposure level of the average urban resident to outdoor particulate matter under 10 microns (PM10). Data for countries and aggregates for regions and income groups are urban-population-weighted PM10 levels in residential areas of cities with more than 100,000 residents; they are available at www.worldbank.org/research. Data for selected cities are in table 3.13.

Significant uncertainties exist around these estimates, and caution should be used in interpreting them. But they do allow for cross-country comparisons of the relative risk of particulate matter pollution that urban residents face. Major sources of urban outdoor particulate matter pollution are emissions from traffic and industrial sources, but nonanthropogenic sources such as dust storms may also be a significant contributor for some cities. Estimates of economic damages from death and illness due to particulate matter pollution are shown in table 3.15.

Definitions

• **Motor vehicles** include cars, buses, and freight vehicles but not two-wheelers. Population figures refer to the midyear population in the year for which data are available. Roads refer to motorways, highways, main or national roads, and secondary or regional roads. A motorway is a road specially designed and built for motor traffic that separates the traffic flowing in opposite directions. • **Passenger cars** refer to road motor vehicles, other than two-wheelers, intended for the carriage of passengers and designed to seat no more than nine people (including the driver). • **Two-wheelers** refer to mopeds and motorcycles. • **Road traffic** is the number of vehicles multiplied by the average distances they travel. • **Particulate matter concentrations** refer to fine suspended particulates less than 10 microns in diameter that are capable of penetrating deep into the respiratory tract and causing significant health damage. The state of a country's technology and pollution controls is an important determinant of particulate matter concentrations.

3.12a

The 15 countries with the fewest passenger cars per 1,000 people in 2003—and the 15 with the most

Country	Number of cars	Country	Number of cars
Bangladesh	0.5	New Zealand	613
Ethiopia	1	Canada	561
Sierra Leone	2	Germany	545
Uganda	2	Italy	545
Bolivia	3	Switzerland	511
Gambia, The	6	Austria	501
India	6	France	495
Pakistan	7	United States	482
Kenya	8	Belgium	470
Afghanistan	9	Spain	455
Philippines	9	Sweden	455
China	10	Slovenia	446
Senegal	11	United Kingdom	439
Syrian Arab Republic	12	Finland	433
Sri Lanka	13	Japan	433

Source: Table 3.12.

Data sources

Data on vehicles and traffic are from the IRF's electronic files and its annual *World Road Statistics*. Data on particulate matter concentrations are from Kiran Dev Pandey, David Wheeler, Bart Ostro, Uwe Deichmann, Kirk Hamilton, and Katie Bolt's "Ambient Particulate Matter Concentrations in Residential and Pollution Hotspot Areas of World Cities: New Estimates Based on the Global Model of Ambient Particulates (GMAPS)" (2006).