3.13 Traffic and congestion

	Motor vehicles		Passenger cars	Road density	Road sector fuel consumption		Transport sector fuel consumption		Fuel price		Particulate matter concentration	
	per 1,000 people	per kilometer of road	per 1,000 people	km. of road per 100 sq. km. of land area	% of total consumption	liters per capita	liters per capita Diesel	liters per capita Gasoline	$ per liter Super grade gasoline	$ per liter Diesel	Urban-population-weighted PM10 micrograms per cubic meter	
	2006	2006	2006	2006	2006	2006	2006	2006	2008	2008	1990	2006
Afghanistan	..	9	..	6	..	..	..	..	1.05	0.96	78	41
Albania	97	15	71	63	27	225	156	77	1.36	1.31	92	44
Algeria	91	27	58	5	14	179	98	60	0.34	0.20	115	71
Angola	..	..	8	4	11	82	48	31	0.53	0.39	142	66
Argentina	..	..	146	8	19	396	217	94	0.78	0.58	105	73
Armenia	..	..	..	25	7	71	0	67	1.08	1.11	453	59
Australia	671	17	542	11	19	1,321	418	781	0.74	0.94	23	15
Austria	552	43	507	128	20	964	631	275	1.37	1.43	38	33
Azerbaijan	61	10	57	68	11	211	92	100	0.74	0.56	226	60
Bangladesh	2	1	1	166	4	8	9	2	1.17	0.70	231	135
Belarus	..	..	183	46	5	171	129	62	1.33	1.06	23	6
Belgium	535	36	474	499	13	897	731	163	1.50	1.34	30	22
Benin	..	..	13	17	22	83	29	50	1.03	1.03	75	46
Bolivia	49	7	15	6	20	149	70	56	0.68	0.53	120	94
Bosnia and Herzegovina	..	..	..	43	15	250	159	87	1.13	1.18	36	19
Botswana	113	7	47	4	26	327	114	199	0.88	1.02	95	67
Brazil	170	18	136	20	22	308	166	86	1.26	1.03	40	23
Bulgaria	360	63	314	37	12	383	220	92	1.28	1.37	111	57
Burkina Faso	7	7	5	34	..	..	..	..	1.38	1.33	151	84
Burundi	..	..	1	48	..	..	..	..	1.39	1.23	56	29
Cambodia	36	37	25	22	8	32	19	12	0.94	0.89	86	46
Cameroon	11	3	11	11	10	46	25	19	1.14	1.04	116	62
Canada	582	13	561	14	16	1,537	452	1,084	0.76	0.90	25	17
Central African Republic	..	..	1	4	..	..	..	..	1.44	1.44	62	44
Chad	6	2	..	3	..	..	..	..	1.30	1.32	217	109
Chile	157	26	97	11	18	378	232	149	0.95	0.95	88	48
China	28	11	18	36	5	76	48	45	0.99	1.01	114	73
Hong Kong, China	70	245	52	180	8	250	187	53	1.95	1.16	..	..
Colombia	59	16	37	15	23	186	83	90	1.04	0.73	39	22
Congo, Dem. Rep.	..	..	..	7	1	3	0	3	1.23	1.21	73	47
Congo, Rep.	..	..	8	5	22	85	55	27	0.81	0.57	135	64
Costa Rica	198	24	146	70	29	358	175	164	1.24	1.10	45	36
Côte d'Ivoire	..	..	7	25	5	24	19	9	1.33	1.20	94	36
Croatia	366	56	323	51	21	487	295	184	1.27	1.37	44	30
Cuba	..	..	..	55	7	79	23	47	1.67	1.51	44	17
Czech Republic	394	31	399	163	12	650	399	230	1.37	1.45	67	21
Denmark	437	33	354	168	20	904	520	390	1.54	1.54	30	19
Dominican Republic	115	..	78	26	20	192	62	119	1.04	0.94	44	20
Ecuador	66	20	39	15	31	310	180	148	0.51	0.27	38	25
Egypt, Arab Rep.	..	..	29	9	16	157	93	52	0.49	0.20	223	119
El Salvador	..	..	24	48	20	161	84	69	0.78	0.81	46	33
Eritrea	..	..	..	3	6	11	10	1	2.53	1.07	118	56
Estonia	477	11	367	126	14	619	375	269	1.18	1.30	45	13
Ethiopia	2	4	1	3	5	16	13	2	0.92	0.89	112	68
Finland	542	36	470	23	11	898	499	416	1.57	1.39	23	18
France	598	39	496	141	15	809	590	191	1.52	1.45	18	13
Gabon	..	..	..	3	8	128	91	32	1.14	0.90	10	8
Gambia, The	7	3	5	33	..	..	..	..	0.79	0.75	144	86
Georgia	71	16	56	29	16	139	44	87	1.09	1.16	208	47
Germany	598	213	565	185	15	748	374	312	1.56	1.56	27	19
Ghana	18	9	12	25	12	58	29	29	0.90	0.90	39	34
Greece	522	47	409	89	21	674	269	415	1.23	1.41	67	36
Guatemala	68	53	53	13	20	149	66	76	0.86	0.82	63	62
Guinea	14	4	8	10	..	..	..	..	1.02	1.02	108	70
Guinea-Bissau	1	1	..	12	..	..	..	..	0.00	0.00	119	72
Haiti	..	..	..	15	5	16	19	15	1.16	0.89	70	37

3.13 Traffic and congestion

	Motor vehicles		Passenger cars	Road density	Road sector fuel consumption		Transport sector fuel consumption		Fuel price		Particulate matter concentration	
	per 1,000 people	per kilometer of road	per 1,000 people	km. of road per 100 sq. km. of land area	% of total consumption	liters per capita	liters per capita Diesel	liters per capita Gasoline	$ per liter Super grade gasoline	$ per liter Diesel	Urban-population-weighted PM10 micrograms per cubic meter	
	2006	2006	2006	2006	2006	2006	2006	2006	2008	2008	1990	2006
Honduras	67	31	52	12	17	127	64	57	0.80	0.80	45	43
Hungary	374	20	292	172	15	496	307	176	1.27	1.38	36	19
India	12	3	8	100	6	33	23	10	1.09	0.70	112	65
Indonesia	109	62	..	20	12	117	50	69	0.60	0.46	137	83
Iran, Islamic Rep.	..	..	24	10	21	612	239	331	0.53	0.03	86	51
Iraq	..	..	30	10	32	428	161	244	0.03	0.01	146	115
Ireland	447	20	382	132	29	1,222	676	518	1.56	1.64	25	16
Israel	293	115	239	85	16	574	185	357	1.47	1.27	71	31
Italy	667	81	595	162	21	779	480	252	1.57	1.63	42	27
Jamaica	188	24	138	201	12	246	163	230	0.74	0.84	59	43
Japan	586	63	441	316	14	689	252	406	1.74	1.54	43	30
Jordan	127	91	88	9	22	332	167	156	0.61	0.61	110	45
Kazakhstan	139	23	114	3	5	241	46	207	0.83	0.72	43	19
Kenya	18	10	9	11	6	34	21	13	1.20	1.14	67	36
Korea, Dem. Rep.	..	..	..	21	2	16	9	7	0.76	0.95	165	68
Korea, Rep.	328	156	240	102	12	653	363	171	1.65	1.33	51	35
Kuwait	422	181	349	32	13	1,441	356	1,002	0.24	0.20	75	97
Kyrgyz Republic	..	..	39	9	9	55	0	52	0.80	0.88	75	22
Lao PDR	57	10	..	13	..	..	..	..	0.92	0.76	91	49
Latvia	415	14	357	108	22	528	342	191	1.12	1.23	38	16
Lebanon	..	..	403	67	28	384	3	355	0.76	0.76	43	36
Lesotho	..	..	..	20	..	..	..	..	0.79	0.93	86	41
Liberia	..	..	6	10	..	..	..	..	0.74	1.03	61	40
Libya	257	..	232	5	18	620	364	227	0.14	0.12	106	88
Lithuania	513	22	468	123	16	475	284	119	1.13	1.22	53	19
Macedonia, FYR	163	25	150	52	12	196	109	62	1.15	1.12	46	21
Madagascar	..	..	..	8	..	..	..	..	1.55	1.43	78	34
Malawi	..	..	..	16	..	..	..	..	1.78	1.67	75	33
Malaysia	272	72	225	28	19	588	211	355	0.53	0.53	37	23
Mali	..	..	..	1	..	..	..	..	1.30	1.10	274	152
Mauritania	..	..	..	1	..	..	..	..	1.49	1.06	147	86
Mauritius	138	89	104	99	..	..	..	..	0.74	0.56	23	18
Mexico	222	65	147	18	26	514	151	335	0.74	0.54	69	36
Moldova	94	31	84	38	7	75	55	22	1.20	1.04	97	36
Mongolia	43	2	28	3	11	144	39	127	1.38	1.42	198	110
Morocco	59	29	46	13	3	16	8	15	1.29	0.83	34	21
Mozambique	..	..	..	4	4	19	16	4	1.71	1.37	111	28
Myanmar	6	..	4	4	8	29	19	9	0.43	0.52	107	58
Namibia	85	4	42	5	37	316	101	196	0.78	0.88	74	47
Nepal	..	..	3	12	3	12	8	2	1.13	0.82	67	34
Netherlands	486	62	429	372	14	826	492	300	1.68	1.45	46	34
New Zealand	722	32	609	35	25	1,237	536	660	1.09	0.85	16	14
Nicaragua	46	13	18	14	14	101	63	37	0.87	0.82	48	28
Niger	5	4	4	1	..	..	..	..	0.99	0.97	220	132
Nigeria	..	..	17	21	7	64	8	52	0.59	1.13	175	45
Norway	546	27	439	29	13	863	644	378	1.63	1.63	24	15
Oman	..	..	156	11	9	649	61	548	0.31	0.38	148	108
Pakistan	14	8	10	34	10	56	47	8	0.84	0.77	224	120
Panama	103	27	73	15	16	164	140	153	0.67	0.68	58	35
Papua New Guinea	..	..	5	4	..	..	..	..	0.94	0.90	34	21
Paraguay	85	15	50	7	27	206	165	32	1.17	0.96	106	77
Peru	47	16	30	6	25	145	103	32	1.42	0.99	98	54
Philippines	34	14	9	67	14	82	53	36	0.91	0.81	55	23
Poland	416	35	351	135	13	388	198	125	1.43	1.40	59	37
Portugal	507	67	471	90	24	683	473	186	1.61	1.47	51	23
Puerto Rico	..	..	..	289	..	..	..	..	0.65	0.78	27	21

3.13 Traffic and congestion

	Motor vehicles		Passenger cars	Road density	Road sector fuel consumption		Transport sector fuel consumption		Fuel price		Particulate matter concentration	
	per 1,000 people	per kilometer of road	per 1,000 people	km. of road per 100 sq. km. of land area	% of total consumption	liters per capita	liters per capita Diesel	liters per capita Gasoline	$ per liter Super grade gasoline	$ per liter Diesel	Urban-population-weighted PM10 micrograms per cubic meter	
	2006	2006	2006	2006	2006	2006	2006	2006	2008	2008	1990	2006
Romania	*180*	*20*	*156*	*83*	10	218	138	78	1.11	1.22	36	14
Russian Federation	228	35	188	5	6	338	119	230	0.89	0.86	41	18
Rwanda	*3*	..	*1*	*57*	..	..	..	..	1.37	1.37	49	26
Saudi Arabia	..	*20*	*415*	*10*	18	1,329	590	672	0.16	0.09	161	113
Senegal	*14*	*9*	*10*	*7*	16	47	38	9	1.35	1.26	97	95
Serbia	244	46	204	44	14	*236*	*160*	68	1.11	1.29	33[a]	15[a]
Sierra Leone	*4*	*2*	*2*	*16*	..	..	..	..	0.91	0.91	92	50
Singapore	141	194	105	461	7	608	374	206	1.07	0.90	106	41
Slovak Republic	287	35	247	89	9	379	227	132	1.57	1.68	41	15
Slovenia	531	28	493	190	21	879	485	372	1.18	1.26	*40*	30
Somalia	..	..	..	*3*	..	..	..	..	1.12	1.15	78	31
South Africa	151	*16*	103	*30*	11	345	136	198	0.87	0.95	34	21
Spain	*550*	*35*	*445*	*132*	22	866	708	185	1.23	1.28	42	32
Sri Lanka	55	11	17	*148*	16	92	63	27	1.43	0.75	94	82
Sudan	..	..	..	*1*	12	68	44	21	0.65	0.45	296	165
Swaziland	*84*	*25*	*40*	*21*	..	..	..	..	0.86	0.93	56	33
Sweden	516	7	462	155	14	948	414	485	1.38	1.52	15	12
Switzerland	564	59	520	173	20	871	291	548	1.30	1.52	37	26
Syrian Arab Republic	48	23	19	21	24	277	148	115	0.85	0.53	159	75
Tajikistan	..	..	*19*	*19*	37	238	0	226	1.03	1.00	103	50
Tanzania	..	..	*1*	*8*	4	28	20	6	1.11	1.30	57	25
Thailand	..	..	*54*	35	17	328	217	98	0.87	0.64	88	71
Timor-Leste	..	..	..	..	..	..	..	..	1.22	1.35	..	..
Togo	..	..	*10*	*13*	8	35	18	16	0.89	0.88	57	35
Trinidad and Tobago	..	..	..	*162*	5	640	250	357	0.36	*0.24*	142	101
Tunisia	*95*	*49*	*83*	*12*	17	174	118	47	0.96	0.84	74	30
Turkey	124	*20*	84	55	13	199	133	44	1.87	1.63	68	40
Turkmenistan	..	..	..	*5*	5	228	0	217	0.22	0.20	177	55
Uganda	*5*	..	*2*	*17*	..	..	..	..	1.30	1.22	28	12
Ukraine	*128*	*36*	*118*	*28*	5	186	70	119	0.88	0.96	72	21
United Arab Emirates	..	..	*228*	*5*	17	2,147	1,108	936	0.37	0.52	266	127
United Kingdom	*517*	*80*	*457*	171	17	775	427	352	1.44	1.65	25	15
United States	*814*[b]	*31*	*461*[b,c]	*68*	23	2,104	548	1,468	0.56	0.78	30	21
Uruguay	*176*	..	*151*	*102*	24	274	182	76	1.18	1.17	237	175
Uzbekistan	..	..	..	*18*	3	71	15	53	1.35	0.75	85	55
Venezuela, RB	..	..	*94*	*11*	25	678	120	489	0.02	0.01	22	11
Vietnam	*8*	..	..	*68*	12	87	47	38	0.80	0.77	123	55
West Bank and Gaza	*36*	18	*29*	80	..	..	..	..	1.34	1.25	..	..
Yemen, Rep.	..	..	*19*	*14*	31	119	34	73	0.30	0.17	..	..
Zambia	..	..	..	*12*	4	30	16	16	1.70	1.61	96	40
Zimbabwe	..	..	*45*	*25*	4	34	21	13	1.30	1.05	35	27
World	**.. w**	**.. w**	***118* w**	**26 w**	**14 w**	**301 w**	**128 w**	**164 w**	**1.11 m**	**1.03 m**	**80 w**	**50 w**
Low income	..	..	..	..	7	42	21	20	1.12	1.03	143	69
Middle income	*46*	*13*	*41*	23	10	146	72	72	0.91	0.90	91	56
Lower middle income	*19*	*10*	*14*	40	8	95	53	46	0.88	0.83	112	67
Upper middle income	*172*	..	*139*	..	13	360	154	178	1.12	1.03	53	30
Low & middle income	*38*	..	*38*	*15*	10	125	62	61	1.03	0.95	98	58
East Asia & Pacific	27	11	18	35	6	95	55	51	0.92	0.85	112	69
Europe & Central Asia	*162*	*30*	184	*9*	8	263	116	139	1.13	1.13	63	27
Latin America & Carib.	*155*	..	*115*	*18*	23	329	143	152	0.87	0.83	59	35
Middle East & N. Africa	..	..	*33*	..	20	297	131	146	0.61	0.53	124	72
South Asia	*12*	*3*	*8*	75	6	33	24	9	1.09	0.76	134	78
Sub-Saharan Africa	..	..	..	..	8	66	27	37	1.14	1.06	113	53
High income	*630*	*41*	*455*	*76*	19	1,210	468	691	1.28	1.36	37	26
Euro area	*604*	*66*	*418*[d]	*123*	17	801	514	257	1.54	1.44	33	23

a. Includes Montenegro. b. Data are from the U.S. Federal Highway Administration. c. Excludes personal passenger vans, passenger minivans, and utility-type vehicles, which are all treated as trucks. d. Data are from the European Commission and the European Road Federation.

Traffic and congestion

About the data

Traffic congestion in urban areas constrains economic productivity, damages people's health, and degrades the quality of life. The particulate air pollution emitted by motor vehicles—the dust and soot in exhaust—is far more damaging to human health than once believed. (For information on particulate matter and other air pollutants, see table 3.14.)

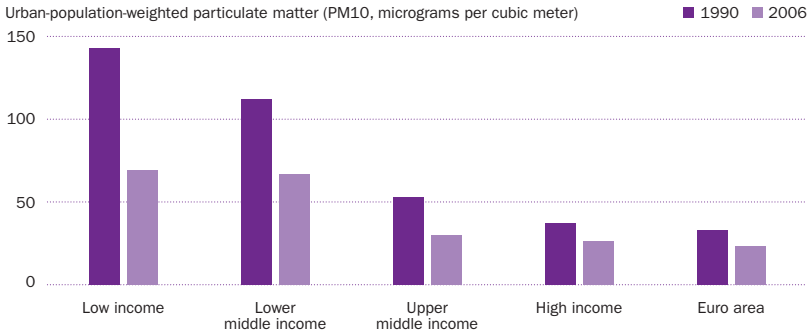
In recent years ownership of passenger cars has increased, and expanded economic activity has led to more goods and services transported by road over greater distances (see table 5.9). These developments have increased demand for roads and vehicles, adding to urban congestion, air pollution, health hazards, and 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 and the cost of 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 and particulate matter—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. Primary sources are national road associations. If they lack data or do not respond, other agencies are contacted, including road directorates, ministries of transport or public works, and central statistical offices. As a result, data quality is uneven. Coverage of each indicator may differ across countries because of different definitions. Comparability is also limited when time series data are reported. The IRF took steps to improve the quality of the data in its *World Road Statistics 2008.* Because this effort covers 1999–2006 only, time series data may not be comparable. Another reason is coverage. For example, for the United States the 2005 estimate for passenger cars from the U.S. Federal Highway Administration excludes personal passenger vans, passenger minivans, and utility-type vehicles, which are all treated as trucks. Moreover, the data do not cover vehicle quality or age. Road density is a rough indicator of accessibility and does not capture road width, type, or condition. Thus comparisons over time and across countries should be made with caution.

Data on fuel prices are compiled by the German Agency for Technical Cooperation (GTZ), from its global network, and other sources, including the Allgemeiner Deutscher Automobile Club (for Europe) and the Latin American Energy Organization (for Latin America). Local prices are converted to U.S. dollars using the exchange rate in the *Financial Times* international monetary table on the survey date. When multiple exchange rates exist, the market, parallel, or black market rate is used. Prices were compiled in mid-November 2008, when crude oil prices had dropped to $48 a barrel Brent (from a high of $148 in July).

Considerable uncertainty surrounds estimates of particulate matter concentrations, and caution should be used in interpreting them. They allow for cross-country comparisons of the relative risk of particulate matter pollution facing urban residents. Major sources of urban outdoor particulate matter pollution are traffic and industrial emissions, but nonanthropogenic sources such as dust storms may also be a substantial contributor for some cities. Country technology and pollution controls are important determinants of particulate matter. Data on particulate matter for selected cities are in table 3.14. Estimates of economic damages from death and illness due to particulate matter pollution are in table 3.16.

Particulate matter concentration has fallen in all income groups, and the higher the income, the lower the concentration **3.13a**



Source: Table 3.13.

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 designed and built for motor traffic that separates the traffic flowing in opposite directions. • **Passenger cars** are 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). • **Road density** is the ratio of the length of the country's total road network to the country's land area. The road network includes all roads in the country—motorways, highways, main or national roads, secondary or regional roads, and other urban and rural roads. • **Road sector fuel consumption** is the average fuel used per capita in the roads sector. • **Transport sector fuel consumption** is the average volume of fuel consumed per capita in the transport sector. • **Fuel price** is the pump price of super grade gasoline (usually 95 octane) and of diesel fuel. Prices are converted from the local currency to U.S. dollars (see *About the data*). • **Particulate matter concentration** is fine suspended particulates of less than 10 microns in diameter (PM10) that are capable of penetrating deep into the respiratory tract and causing significant health damage. Data are urban-population-weighted PM10 levels in residential areas of cities with more than 100,000 residents. The estimates represent the average annual exposure level of the average urban resident to outdoor particulate matter.

Data sources

Data on vehicles, road density, and fuel consumption are from the IRF's electronic files and its annual *World Road Statistics,* except where noted. Data on fuel prices are from the GTZ's electronic files. 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).