



## 5.9 Transport infrastructure

	Roads			Railways			Air		
	Paved roads %	Normalized road index	Goods hailed million ton-km	Passenger- km per PPP \$ million of GDP	Goods transported ton-km per PPP \$ million of GDP	Diesel locomotives available %	Aircraft departures thousands	Passengers carried thousands	Air freight million ton-km
	1998	1998	1998	1998	1998	1995-98	1998	1998	1998
Albania	30.0	53	1,830	9,611	2,029	..	1	21	0
Algeria	68.9	182	..	13,564	..	..	44	3,382	19
Angola	25.0	..	..	..	..	..	7	553	38
Argentina	29.5	88	..	..	..	..	145	8,447	246
Armenia	100.0	171	213	6,612	53,150	30	5	365	10
Australia	38.7	113	..	..	..	..	378	30,186	1,904
Austria	100.0	130	15,700	52,099	79,889	89	128	5,872	269
Azerbaijan	92.3	..	706	..	..	..	10	669	93
Bangladesh	9.5	71	..	24,687	5,148	81	12	1,153	141
Belarus	95.6	150	9,747	205,057	469,369	93	6	226	4
Belgium	80.7	90	36,000	29,898	32,071	86	213	8,748	473
Benin	20.0	81	..	..	..	..	2	91	14
Bolivia	5.5	62	..	..	..	..	32	2,116	43
Bosnia and Herzegovina	52.3	..	..	..	..	..	1	50	0
Botswana	23.5	260	..	..	..	..	5	124	0
Brazil	9.3	127	..	..	31,663	..	610	28,091	1,714
Bulgaria	92.0	95	307	119,375	154,935	80	15	828	30
Burkina Faso	16.0	90	..	..	..	..	2	102	14
Burundi	..	..	..	..	..	..	1	12	0
Cambodia	7.5	..	1,200	..	78,146	..	..	..	..
Cameroon	12.5	77	..	13,282	37,719	68	7	278	31
Canada	35.3	68	72,240	1,979	440,137	83	318	24,653	1,806
Central African Republic	2.7	47	60	..	..	..	2	91	14
Chad	0.8	13	..	..	..	..	2	98	14
Chile	13.8	57	..	6,398	7,959	65	119	5,150	1,308
China	..	..	..	91,741	304,775	82	511	53,234	3,037
Hong Kong, China	100.0	..	..	..	..	..	235	12,254	4,185
Colombia	12.0	42	..	62	1,945	..	235	9,290	801
Congo, Dem. Rep.	..	..	..	695	..	15	..	..	..
Congo, Rep.	9.7	125	..	93,827	..	35	10	241	14
Costa Rica	21.0	247	3,070	..	..	50	37	1,170	96
Côte d'Ivoire	9.7	84	..	6,125	19,827	53	4	162	14
Croatia	..	..	..	30,318	60,241	63	17	828	2
Cuba	49.0	..	..	..	..	53	20	1,138	73
Czech Republic	100.0	..	33,912	55,011	143,684	86	30	1,601	25
Denmark	100.0	96	14,700	41,923	12,268	..	115	5,947	201
Dominican Republic	49.4	124	..	..	..	..	1	34	0
Ecuador	16.8	123	3,753	..	..	..	27	1,919	59
Egypt, Arab Rep.	78.1	176	31,500	306,406	20,062	..	40	3,895	255
El Salvador	19.8	54	..	..	..	..	19	1,694	15
Eritrea	21.8	..	..	..	..	..	..	..	..
Estonia	22.1	111	3,791	21,190	519,698	80	11	297	1
Ethiopia	15.0	42	..	..	..	..	27	790	127
Finland	64.0	68	25,400	31,436	92,017	88	119	6,771	276
France	100.0	135	237,200	51,844	43,309	93	692	42,232	4,752
Gabon	8.2	41	..	11,575	67,137	89	10	467	35
Gambia, The	35.4	252	..	..	..	..	..	..	..
Georgia	93.5	..	98	30,492	146,315	34	2	110	1
Germany	99.1	..	301,800	..	..	92	673	49,280	6,242
Ghana	24.1	119	..	..	..	..	4	210	30
Greece	91.8	111	96,200	12,386	2,196	..	91	6,403	113
Guatemala	27.6	62	..	..	..	..	7	506	40
Guinea	16.5	154	..	..	..	..	1	36	1
Guinea-Bissau	10.3	..	..	..	..	..	1	20	0
Haiti	24.3	..	..	..	..	..	..	..	..
Honduras	20.3	120	..	..	..	..	..	..	..



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			million ton-km	\$ million of GDP	ton-km per PPP \$ million of GDP	available %			
1998	1998	1998	1998	1998	1998	1995-98	1998	1998	1998
Hungary	43.4	127	..	64,345	74,713	64	28	1,749	37
India	45.7	..	..	188,510	137,082	90	196	16,521	531
Indonesia	46.3	235	..	29,795	9,125	83	197	12,614	696
Iran, Islamic Rep.	50.0	..	..	19,626	46,269	47	80	9,200	103
Iraq	86.0	..	..	..	..	..	..	..	..
Ireland	94.1	216	5,500	19,839	4,875	82	123	10,401	130
Israel	100.0	97	..	3,411	9,605	92	50	3,699	1,117
Italy	100.0	115	207,200	39,886	18,885	79	338	27,463	1,476
Jamaica	70.7	..	..	..	..	..	13	1,454	24
Japan	74.9	74	306,263	79,919	7,854	88	637	101,701	7,514
Jordan	100.0	122	..	..	40,974	90	15	1,187	219
Kazakhstan	86.5	145	4,637	180,227	1,498,375	..	10	566	15
Kenya	13.9	141	..	12,585	41,917	..	20	1,138	54
Korea, Dem. Rep.	6.4	..	..	..	..	..	1	64	2
Korea, Rep.	74.5	135	74,504	48,617	20,362	88	208	27,109	7,290
Kuwait	80.6	..	..	..	..	..	19	2,241	322
Kyrgyz Republic	91.1	..	350	..	..	..	15	620	6
Lao PDR	13.8	122	..	..	..	..	4	124	1
Latvia	38.6	176	4,108	110,948	788,435	88	10	229	1
Lebanon	95.0	..	..	..	..	..	10	716	108
Lesotho	17.9	118	..	..	..	..	2	28	0
Libya	57.1	..	..	..	..	..	6	571	0
Lithuania	91.0	274	5,611	30,001	346,800	88	10	259	3
Macedonia, FYR	63.8	52	1,210	17,428	47,137	45	8	489	0
Madagascar	11.6	140	..	..	..	..	18	601	31
Malawi	19.0	202	..	3,095	11,185	..	4	158	4
Malaysia	75.1	..	..	8,314	7,339	65	174	13,654	1,376
Mali	12.1	71	..	29,433	34,053	..	2	91	14
Mauritania	11.3	44	..	..	..	..	5	250	14
Mauritius	96.0	190	..	..	..	..	11	848	167
Mexico	29.7	102	154,083	2,580	62,102	68	292	17,717	278
Moldova	87.3	128	780	..	..	..	3	118	0
Mongolia	3.4	..	123	242,287	653,947	..	5	240	1
Morocco	52.3	142	2,086	17,268	49,613	75	40	3,012	58
Mozambique	18.7	112	110	..	..	..	5	201	6
Myanmar	12.2	..	..	..	..	..	15	333	1
Namibia	8.3	167	..	5,887	129,941	89	8	214	32
Nepal	41.5	70	..	..	..	..	29	754	18
Netherlands	90.0	62	45,000	42,090	9,938	88	188	18,676	3,833
New Zealand	58.1	94	..	..	51,977	..	236	8,655	826
Nicaragua	10.1	60	..	..	..	..	1	51	8
Niger	7.9	26	..	..	..	..	2	91	14
Nigeria	30.9	274	..	26,710	4,834	18	8	313	8
Norway	74.5	100	11,838	..	..	..	305	14,292	203
Oman	30.0	..	..	..	..	..	16	1,849	105
Pakistan	57.0	415	90,268	87,755	26,278	..	69	5,414	402
Panama	28.1	115	..	..	..	..	22	860	22
Papua New Guinea	3.5	26	..	..	..	..	30	1,110	15
Paraguay	9.5	..	..	..	..	..	4	222	0
Peru	12.9	43	..	1,432	4,757	..	45	2,775	9
Philippines	19.8	83	..	976	4	..	62	6,732	363
Poland	65.6	118	69,543	87,112	209,664	55	38	2,213	104
Portugal	..	70	13,500	31,403	13,975	88	98	7,023	248
Puerto Rico	100.0	..	..	..	..	..	..	..	..
Romania	67.6	82	15,785	105,645	146,252	78	15	908	12
Russian Federation	..	..	..	151,547	1,042,132	..	281	15,224	737



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	1998	1998	1998	1998	1998	1995-98	1998	1998	1998
Rwanda	9.1	116	..	..	..	..	..	..	..
Saudi Arabia	30.1	82	..	1,007	3,843	80	101	11,816	934
Senegal	29.3	125	..	6,223	35,183	79	4	121	14
Sierra Leone	8.0	97	..	..	..	..	0	0	0
Singapore	97.3	..	..	..	..	..	62	13,331	4,714
Slovak Republic	99.0	..	4,750	59,138	224,788	87	5	107	0
Slovenia	90.6	95	325	22,804	92,945	..	10	460	3
South Africa	11.8	101	..	28,670	283,262	96	93	6,480	301
Spain	99.0	97	16,500	27,378	17,569	87	388	31,594	767
Sri Lanka	95.0	131	30	64,743	2,035	..	9	1,213	157
Sudan	36.3	..	..	4,511	41,113	42	4	499	6
Sweden	77.5	121	33,100	38,261	99,690	..	223	11,878	294
Switzerland	..	..	13,250	..	..	..	250	14,299	1,962
Syrian Arab Republic	23.1	..	..	5,374	26,484	100	9	685	14
Tajikistan	82.7	..	..	..	..	..	3	592	3
Tanzania	4.2	77	..	71,671	71,671	66	6	220	4
Thailand	97.5	205	..	33,653	8,835	72	94	15,015	1,522
Togo	31.6	152	..	..	..	..	2	91	14
Trinidad and Tobago	51.1	275	..	..	..	..	13	804	18
Tunisia	78.9	173	..	20,214	42,976	71	20	1,859	20
Turkey	28.0	43	152,210	15,146	20,310	74	104	9,949	260
Turkmenistan	81.2	..	..	..	..	..	9	521	2
Uganda	..	..	..	..	4,990	..	1	100	1
Ukraine	96.5	132	18,266	310,851	987,824	87	30	1,066	27
United Arab Emirates	100.0	7	..	..	..	..	41	5,264	900
United Kingdom	100.0	59	152,500	..	..	..	802	61,940	4,663
United States	58.8	98	1,534,430	1,050	213,751	..	7,824	588,171	25,756
Uruguay	90.0	151	..	7,941	6,290	..	10	557	12
Uzbekistan	87.3	..	..	44,314	317,391	..	12	1,560	7
Venezuela, RB	33.6	136	..	0	354	65	67	3,737	63
Vietnam	25.1	..	..	21,841	11,367	95	30	2,304	96
West Bank and Gaza	..	..	..	..	..	..	..	..	..
Yemen, Rep.	8.1	..	..	..	..	..	7	765	12
Yugoslavia, FR (Serb./Mont.)	59.3	..	1,244	..	..	..	..	..	..
Zambia	..	235	..	28,868	57,858	62	1	49	1
Zimbabwe	47.4	120	..	16,784	140,231	70	18	789	140
<b>World</b>	<b>43.1 m</b>	<b>114 m</b>					<b>19,654 s</b>	<b>1,466,848 s</b>	
<b>Low income</b>	<b>18.3</b>	<b>120</b>					<b>1,302</b>	<b>104,083</b>	
Excl. China & India	18.3	119					594	34,264	
<b>Middle income</b>	<b>50.6</b>	<b>124</b>					<b>3,677</b>	<b>241,704</b>	
Lower middle income	50.7	124					1,244	84,422	
Upper middle income	43.1	118					2,433	157,283	
<b>Low &amp; middle income</b>	<b>29.5</b>	<b>121</b>					<b>4,979</b>	<b>345,787</b>	
East Asia & Pacific	17.4	..					1,450	133,490	
Europe & Central Asia	86.5	127					676	41,143	
Latin America & Carib.	26.0	115					1,797	89,378	
Middle East & N. Africa	50.2	..					401	40,144	
South Asia	57.0	131					323	25,390	
Sub-Saharan Africa	15.0	118					332	16,242	
<b>High income</b>	<b>93.9</b>	<b>97</b>					<b>14,674</b>	<b>1,121,061</b>	
Europe EMU	90.0	97					2,984	208,761	



## Transport infrastructure 5.9

### About the data

Transport infrastructure—highways, railways, ports and waterways, and airports and air traffic control systems—and the services that flow from it are crucial to the activities of households, producers, and governments. Because performance indicators vary significantly by transport mode and by focus (whether physical infrastructure or the services flowing from that infrastructure), highly specialized and carefully specified indicators are required. The table provides selected indicators of the size and extent of roads, railways, and air transport systems and the volume of freight and passengers carried.

Data for most transport sectors are not internationally comparable. Unlike for demographic statistics, national income accounts, and international trade data, the collection of infrastructure data has not been “internationalized.” Data on roads are collected by the International Road Federation (IRF), and data on air transport by the International Civil Aviation Organization. National road associations are the primary source of IRF data; in countries where such an association is lacking or does not respond, other agencies are contacted, such as road directorates, ministries of transport or public works, or central statistical offices. As a result the compiled data are of uneven quality.

Even when data are available, they are often of limited value because of incompatible definitions, inappropriate geographical units of observation, lack of timeliness, and variations in the nature of the terrain. Data on passengers carried, for example, may be distorted because of “ticketless” travel or breaks in journeys; in such cases the statistics may report the number of passenger-kilometers for two passengers rather than one. Measurement problems are compounded because the mix of transported commodities changes over time, and in some cases shorter-haul traffic has been excluded from intercity traffic. Finally, the quality of transport service (reliability, transit time, and condition of goods delivered) is rarely measured but may be as important as quantity in assessing an economy’s transport system. Serious efforts are needed to create international databases whose comparability and accuracy can be gradually improved.

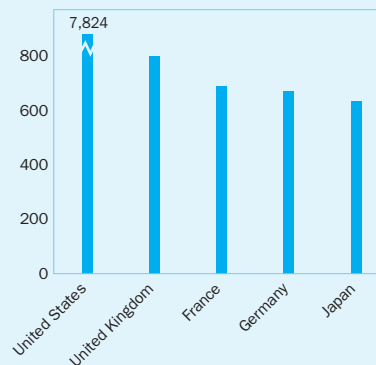
Some form of normalization is required to measure the relative size of an indicator over time or across countries. The table presents normalized indicators for railway passengers and goods transported by rail as well as the normalized road index. While the rail traffic indicators are normalized by a single indicator—the size of the economy—the normalized road index uses a multidimensional regression function to estimate a country’s “normal,” or expected, stock of

roads (Armington and Dikhanov 1996). This index is an attempt to assess the adequacy of the stock of paved roads in a country at a given level of development. Normalizing variables include population, population density, per capita income, urbanization, and regional characteristics. The value of the normalized road index shows whether a country’s stock of paved roads exceeds or falls short of the average for countries with similar characteristics. There are many reasons that the stock of paved roads may be considerably smaller or larger than the expected stock. The region-specific dummy variables may not adequately capture such country-level variables as variations in terrain (steep mountains, deserts), differing definitions of urban and rural and dispersion of the population, and differing modes of transport (for example, travel by waterway may substitute for road travel).

Figure 5.9

### Air traffic is concentrated in high-income economies

Domestic and international aircraft departures in top five high-income countries, 1998 (thousands)



Source: Table 5.9.

**High-income economies account for about 75 percent of aircraft departures. Among developing economies, Brazil, China, Colombia, Mexico, and Russia lead, with about 40 percent of this group’s air traffic.**

### Definitions

- **Paved roads** are those surfaced with crushed stone (macadam) and hydrocarbon binder or bituminized agents, with concrete, or with cobblestones, as a percentage of all the country’s roads, measured in length.
- **Normalized road index** is the total length of paved roads in a country compared with the expected length, where the expectation is conditioned on population, population density, per capita income, urbanization, and region-specific dummy variables. A value of 100 is “normal.” If the index is more than 100, the country’s stock of paved roads exceeds the average for a country at that level of development.
- **Goods hauled by road** are the volume of goods transported by road vehicles, measured in millions of metric tons times kilometers traveled.
- **Railway passengers** refer to the total number of passengers transported times kilometers traveled per million dollars of GDP measured in purchasing power parity (PPP) terms (see *About the data* for tables 4.11 and 4.12 for discussion of PPP).
- **Goods transported by rail** are the tonnage of goods transported times kilometers traveled per million dollars of GDP measured in purchasing power parity (PPP) terms.
- **Diesel locomotives available** are those in service as a percentage of all diesel locomotives.
- **Aircraft departures** are the number of domestic and international takeoffs of aircraft.
- **Air passengers carried** include both domestic and international aircraft passengers.
- **Air freight** is the sum of the metric tons of freight, express, and diplomatic bags carried on each flight stage (the operation of an aircraft from takeoff to its next landing) multiplied by the stage distance.

### Data sources

The data on roads are from the International Road Federation’s *World Road Statistics* and from Eurostat ([europa.eu.int/eurostat.html](http://europa.eu.int/eurostat.html)). The normalized road index is based on World Bank staff estimates. The railway data are from a database maintained by the World Bank’s Transportation, Water, and Urban Development Department, Transport Division. The air transport data are from the International Civil Aviation Organization’s *Civil Aviation Statistics of the World*.