



BACKGROUND PAPER 14 (PHASE I)

# The Burden of Maintenance: Roads in Sub-Saharan Africa

CROSS-COUNTRY ANNEX

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## About AICD



This study is a product of the Africa Infrastructure Country Diagnostic (AICD), a project designed to expand the world's knowledge of physical infrastructure in Africa. AICD will provide a baseline against which future improvements in infrastructure services can be measured, making it possible to monitor the results achieved from donor support. It should also provide a better empirical foundation for prioritizing investments and designing policy reforms in Africa's infrastructure sectors.



AICD is based on an unprecedented effort to collect detailed economic and technical data on African infrastructure. The project has produced a series of reports (such as this one) on public expenditure, spending needs, and sector performance in each of the main infrastructure sectors—energy, information and communication technologies, irrigation, transport, and water and sanitation. *Africa's Infrastructure—A Time for Transformation*, published by the World Bank in November 2009, synthesizes the most significant findings of those reports.



AICD was commissioned by the Infrastructure Consortium for Africa after the 2005 G-8 summit at Gleneagles, which recognized the importance of scaling up donor finance for infrastructure in support of Africa's development.



The first phase of AICD focused on 24 countries that together account for 85 percent of the gross domestic product, population, and infrastructure aid flows of Sub-Saharan Africa. The countries are: Benin, Burkina Faso, Cape Verde, Cameroon, Chad, Côte d'Ivoire, the Democratic Republic of Congo, Ethiopia, Ghana, Kenya, Lesotho, Madagascar, Malawi, Mozambique, Namibia, Niger, Nigeria, Rwanda, Senegal, South Africa, Sudan, Tanzania, Uganda, and Zambia. Under a second phase of the project, coverage is expanding to include as many other African countries as possible.



Consistent with the genesis of the project, the main focus is on the 48 countries south of the Sahara that face the most severe infrastructure challenges. Some components of the study also cover North African countries so as to provide a broader point of reference. Unless otherwise stated,



therefore, the term “Africa” will be used throughout this report as a shorthand for “Sub-Saharan Africa.”



The World Bank is implementing AICD with the guidance of a steering committee that represents the African Union, the New Partnership for Africa’s Development (NEPAD), Africa’s regional economic communities, the African Development Bank, the Development Bank of Southern Africa, and major infrastructure donors.



Financing for AICD is provided by a multidonor trust fund to which the main contributors are the U.K.’s Department for International Development, the Public Private Infrastructure Advisory Facility, Agence Française de Développement, the European Commission, and Germany’s KfW Entwicklungsbank. The Sub-Saharan Africa Transport Policy Program and the Water and Sanitation Program provided technical support on data collection and analysis pertaining to their respective sectors. A group of distinguished peer reviewers from policy-making and academic circles in Africa and beyond reviewed all of the major outputs of the study to ensure the technical quality of the work.



The data underlying AICD’s reports, as well as the reports themselves, are available to the public through an interactive Web site, [www.infrastructureafrica.org](http://www.infrastructureafrica.org), that allows users to download customized data reports and perform various simulations. Inquiries concerning the availability of data sets should be directed to the editors at the World Bank in Washington, DC.



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## ROADS IN SUB-SAHARAN AFRICA: CROSS-COUNTRY ANNEX

## 1 Basic country data

	Network length		Land	Population 2006			Vehicle
	Classified	Total	Area	Total	Rural	Urban	Fleet
	km	km	Sq km	million	million	million	# vehicles
Benin	8,332	15,700	110,620	9	5	4	100,000
Burkina Faso	15,202	22,310	566,730	2	1	1	130,000
Cameroon	23,581	33,383	465,400	17	7	9	260,000
Chad	28,238	33,400	1,259,200	10	7	3	50,000
Cote d'Ivoire	25,558	26,074	318,000	18	10	8	352,117
Ethiopia	20,627	45,708	1,000,000	73	61	12	142,708
Ghana	40,263	42,623	227,540	23	12	11	653,309
Kenya	56,951	63,265	569,140	35	28	7	330,089
Lesotho	5,299	5,940	30,350	2	1	0	45,000
Madagascar	25,641	29,593	581,540	19	14	5	150,000
Malawi	13,283	15,491	94,080	13	11	2	130,000
Mozambique	29,238	47,550	784,090	20	13	7	187,660
Namibia	45,094	63,161	823,290	2	1	1	177,220
Niger	13,427	16,945	1,266,700	14	12	2	80,000
Nigeria	122,707	158,607	910,770	145	74	71	3,500,000
Rwanda	4,625	14,008	24,670	9	7	2	70,000
Senegal	15,671	18,063	192,530	12	7	5	234,029
South Africa	202,263	364,131	1,214,470	47	19	28	6,549,901
Tanzania	48,730	54,457	883,590	39	30	10	548,326
Uganda	70,922	75,922	197,100	30	26	4	278,595
Zambia	18,285	37,243	743,390	12	8	4	283,237
Grand Total	833,936	1,183,574	12,263,200	551	354	197	14,252,191
Average	39,711	56,361	583,962	26	17	9	678,676
Median	25,558	33,400	569,140	17	11	5	187,660

## ROADS IN SUB-SAHARAN AFRICA: CROSS-COUNTRY ANNEX

Sum of values	Network length		Land	Population			Vehicle
	Classified	Total	Area	Total	Rural	Urban	Fleet
	km	km	Sq km	million	million	million	# vehicles
Subregion							
Central Africa	56,445	80,791	1,749,270	36	22	14	380,000
Eastern Africa	197,229	239,352	2,649,830	177	144	33	1,299,718
Southern Africa	339,103	563,109	4,271,210	115	67	48	7,523,018
Western Africa	241,159	300,322	3,592,890	223	120	102	5,049,455
Income group							
Low income	557,698	716,959	9,729,690	483	325	158	7,220,070
Lower middle income	73,974	102,484	1,319,040	21	10	10	482,220
Upper middle income	202,263	364,131	1,214,470	47	19	28	6,549,901
Country income and dependency status							
Low-income, aid-dependent	406,754	524,952	7,559,720	329	244	85	3,670,070
Low-income, resource dependent	174,526	225,390	2,635,370	171	89	83	3,810,000
Middle Income	252,656	433,232	2,068,110	51	22	29	6,772,121
Country geography							
Coastal	618,386	887,014	6,499,440	367	206	161	12,892,651
Island	25,641	29,593	581,540	19	14	5	150,000
Landlocked	189,908	266,967	5,182,220	165	134	30	1,209,540
Predominant terrain and climate							
Flat and Arid	669,958	963,529	9,870,060	389	226	162	13,175,888
Rolling and Humid	163,978	220,045	2,393,140	163	128	35	1,076,303
Road sector institutions							
Road fund and road agency	180,271	232,023	3,252,420	155	114	42	1,873,680
Road fund only	313,024	410,750	6,693,010	192	141	51	2,094,581
Road agency only	217,934	382,194	1,407,000	59	26	33	6,783,930
No road fund or agency	122,707	158,607	910,770	145	74	71	3,500,000
Fuel levy							
High	252,458	340,924	5,784,710	196	148	49	1,696,003
Low	154,713	203,617	3,396,890	119	80	39	1,863,663
None	426,765	639,033	3,081,600	236	127	109	10,692,525

Sources: AICD RNET outputs from Alberto Nogales, July 2008. Based on AICD Study inputs on road length, type, condition, traffic, and road works costs (year 2007). Population, GDP, and land area (year 2006) from World Development Indicators 2007. Estimates of vehicle fleet and unclassified network length by A. Nogales based on various sources.

## 2 Road network length

	Classified Road Network Length in km				Unclassified	Total
	Primary	Secondary	Tertiary	Sub-Total		
Benin	2,386	2,348	3,597	8,332	7,368	15,700
Burkina Faso	6,705	3,526	4,971	15,202	7,108	22,310
Cameroon	5,838	5,169	12,573	23,581	9,802	33,383
Chad	7,064	5,891	15,283	28,238	5,162	33,400
Cote d'Ivoire	5,752	7,539	12,267	25,558	516	26,074
Ethiopia	4,953	4,768	10,906	20,627	25,081	45,708
Ghana	3,564	7,613	29,086	40,263	2,360	42,623
Kenya	5,532	16,809	34,609	56,951	6,314	63,265
Lesotho	1,483	1,521	2,295	5,299	641	5,940
Madagascar	2,991	6,608	16,042	25,641	3,952	29,593
Malawi	3,444	6,692	3,147	13,283	2,208	15,491
Mozambique	4,909	4,900	19,430	29,238	18,312	47,550
Namibia	4,297	12,065	28,732	45,094	18,067	63,161
Niger	4,011	2,044	7,371	13,427	3,518	16,945
Nigeria	28,614	21,293	72,800	122,707	35,900	158,607
Rwanda	1,060	1,776	1,790	4,625	9,383	14,008
Senegal	2,920	1,860	10,891	15,671	2,392	18,063
South Africa	38,066	38,222	125,975	202,263	161,868	364,131
Tanzania	7,010	21,720	20,000	48,730	5,727	54,457
Uganda	9,171	26,751	35,000	70,922	5,000	75,922
Zambia	3,290	3,763	11,232	18,285	18,958	37,243
Grand Total	153,061	202,878	477,997	833,936	349,638	1,183,574
Average	7,289	9,661	22,762	39,711	16,649	56,361
Median	4,909	5,891	12,573	25,558	6,314	33,400



## ROADS IN SUB-SAHARAN AFRICA: CROSS-COUNTRY ANNEX

Sum of values	Classified Road Network Length in km					Total
	Primary	Secondary	Tertiary	Subtotal	Unclassified	
Subregion						
Central Africa	13,962	12,836	29,646	56,445	24,346	80,791
Eastern Africa	26,665	70,049	100,515	197,229	42,123	239,352
Southern Africa	58,480	73,771	206,852	339,103	224,006	563,109
Western Africa	53,952	46,222	140,984	241,159	59,163	300,322
Income group						
Low income	103,376	145,901	308,422	557,698	159,260	716,959
Lower middle income	11,619	18,755	43,600	73,974	28,510	102,484
Upper middle income	38,066	38,222	125,975	202,263	161,868	364,131
Country income and dependency status						
Low-income, aid-dependent	67,697	118,717	220,339	406,754	118,199	524,952
Low-income, resource dependent	41,516	32,353	100,656	174,526	50,864	225,390
Middle Income	43,847	51,808	157,002	252,656	180,576	433,232
Country geography						
Coastal	108,888	139,538	369,960	618,386	268,627	887,014
Island	2,991	6,608	16,042	25,641	3,952	29,593
Landlocked	41,181	56,732	91,995	189,908	77,059	266,967
Predominant terrain and climate						
Flat and Arid	124,120	149,592	396,245	669,958	293,571	963,529
Rolling and Humid	28,940	53,286	81,752	163,978	56,067	220,045
Road sector institutions						
Road fund and road agency	25,575	53,705	100,991	180,271	51,752	232,023
Road fund only	57,885	87,799	167,340	313,024	97,726	410,750
Road agency only	40,986	40,082	136,866	217,934	164,260	382,194
No road fund or agency	28,614	21,293	72,800	122,707	35,900	158,607
Fuel levy						
High	39,603	71,322	141,533	252,458	88,466	340,924
Low	27,982	39,904	86,827	154,713	48,904	203,617
None	85,476	91,652	249,638	426,765	212,267	639,033
Subregion						
Central Africa	5,658	10,189	20,219	36,065	12,638	48,703
Eastern Africa	3,109	4,434	9,647	17,190	5,434	22,624
Southern Africa	17,095	18,330	49,928	85,353	42,453	127,807

Sources: AICD RNET outputs from Alberto Nogales, July 2008. Based on AICD Study inputs on road length, type, condition, traffic, and road works costs (year 2007). Population, GDP, and land area (year 2006) from World Development Indicators 2007. Estimates of vehicle fleet and unclassified network length by A. Nogales based on various sources.

## 3 Road network densities

	Classified Network Length Density			Total Network Length Density			Network Density per Rural Population	
	by area	by population	by vehicles	by area	by population	by vehicles	Tertiary network	Tertiary & Unclassified
	km/1000km <sup>2</sup>	km/1000 people	km/1000 veh	km/1000km <sup>2</sup>	km/1000 people	km/1000 veh	km/1000 people	km/1000 people
Benin	75	1.0	83	142	1.8	157	0.7	2.1
Burkina Faso	27	8.6	117	39	12.7	172	6.8	16.4
Cameroon	51	1.4	91	72	2.0	128	1.7	3.0
Chad	22	2.8	565	27	3.3	668	2.1	2.8
Cote d'Ivoire	80	1.4	73	82	1.4	74	1.2	1.3
Ethiopia	21	0.3	145	46	0.6	320	0.2	0.6
Ghana	177	1.8	62	187	1.9	65	2.5	2.7
Kenya	100	1.6	173	111	1.8	192	1.2	1.5
Lesotho	175	3.0	118	196	3.3	132	1.6	2.0
Madagascar	44	1.3	171	51	1.6	197	1.2	1.4
Malawi	141	1.0	102	165	1.2	119	0.3	0.5
Mozambique	37	1.5	156	61	2.4	253	1.5	2.9
Namibia	55	22.0	254	77	30.8	356	21.8	35.5
Niger	11	0.9	168	13	1.2	212	0.6	0.9
Nigeria	135	0.8	35	174	1.1	45	1.0	1.5
Rwanda	187	0.5	66	568	1.5	200	0.2	1.5
Senegal	81	1.3	67	94	1.5	77	1.6	1.9
South Africa	167	4.3	31	300	7.7	56	6.6	15.1
Tanzania	55	1.2	89	62	1.4	99	0.7	0.9
Uganda	360	2.4	255	385	2.5	273	1.3	1.5
Zambia	25	1.5	65	50	3.1	131	1.5	3.9
Average	96	2.9	137	138	4.0	187	2.7	4.8
Median	75	1.4	102	82	1.8	157	1.3	1.9

## ROADS IN SUB-SAHARAN AFRICA: CROSS-COUNTRY ANNEX

Average of values	Classified Network Length Density			Total Network Length Density			Network Density per Rural Population	
	by area	by population	by vehicles	by area	by population	by vehicles	Tertiary network	Tertiary & Unclassified
	km/1000km <sup>2</sup>	km/1000 people	km/1000 veh	km/1000km <sup>2</sup>	km/1000 people	km/1000 veh	km/1000 people	km/1000 people
Subregion								
Central Africa	87	1.6	241	222	2.3	332	1.3	2.4
Eastern Africa	134	1.4	165	151	1.6	221	0.9	1.1
Southern Africa	92	4.9	128	128	7.1	178	4.9	8.8
Western Africa	84	2.3	86	105	3.1	115	2.1	3.8
Income group								
Low income	93	1.8	141	133	2.4	191	1.4	2.6
Lower middle income	93	8.8	154	115	12.0	206	8.4	13.5
Upper middle income	167	4.3	31	300	7.7	56	6.6	15.1
Country income and dependency status								
Low-income, aid-dependent	95	1.8	119	137	2.4	169	1.4	2.7
Low-income, resource dependent	69	1.7	230	91	2.1	281	1.6	2.4
Middle Income	132	9.7	134	191	13.9	181	10.0	17.5
Country geography								
Coastal	92	3.5	101	124	4.9	137	3.7	6.2
Island	44	1.3	171	51	1.6	197	1.2	1.4
Landlocked	108	2.3	178	165	3.3	247	1.6	3.4
Predominant terrain and climate								
Flat and Arid	75	3.6	138	101	5.1	183	3.5	6.4
Rolling and Humid	140	1.4	135	212	1.8	196	0.9	1.5
Road sector institutions								
Road fund and road agency	78	5.3	124	91	7.2	183	5.3	8.2
Road fund only	97	2.1	164	145	3.0	218	1.6	3.1
Road agency only	124	2.8	49	197	4.6	66	4.1	8.5
No road fund or agency	135	0.8	35	174	1.1	45	1.0	1.5
Fuel levy								
High	49	4.4	210	65	6.0	288	4.2	6.7
Low	102	1.4	101	162	1.9	143	1.1	1.8
None	154	3.5	101	198	5.1	124	3.5	7.3

Sources: AICD RNET outputs from Alberto Nogales, July 2008. Based on AICD Study inputs on road length, type, condition, traffic, and road works costs (year 2007).

## 4 Road network length by surface class and network type

	Paved road network length in km				Unpaved road network length in km				Percentage of paved length by network type			
	Classified	Primary	Secondary	Tertiary	Classified	Primary	Secondary	Tertiary	Classified	Primary	Secondary	Tertiary
Benin	1,821	1,821	0	0	6,510	565	2,348	3,597	22	76	0	0
Burkina Faso	2,670	2,640	23	7	12,532	4,065	3,502	4,965	18	39	1	0
Cameroon	4,540	3,113	903	523	19,041	2,725	4,266	12,050	19	53	17	4
Chad	986	908	78	0	27,252	6,156	5,813	15,283	3	13	1	0
Cote d'Ivoire	5,689	3,973	1,643	73	19,869	1,779	5,896	12,194	22	69	22	1
Ethiopia	4,698	4,132	255	311	15,928	821	4,513	10,595	23	83	5	3
Ghana	6,616	2,204	3,157	1,255	33,647	1,360	4,456	27,831	16	62	41	4
Kenya	7,982	3,787	3,470	725	48,968	1,744	13,339	33,885	14	68	21	2
Lesotho	1,041	847	191	3	4,258	636	1,330	2,292	20	57	13	0
Madagascar	5,045	2,537	2,142	366	20,596	454	4,466	15,676	20	85	32	2
Malawi	3,004	2,486	423	96	10,278	958	6,270	3,051	23	72	6	3
Mozambique	5,710	4,360	880	471	23,528	549	4,020	18,959	20	89	18	2
Namibia	6,031	4,177	1,622	232	39,062	120	10,443	28,499	13	97	13	1
Niger	3,649	3,549	69	32	9,777	462	1,975	7,340	27	88	3	0
Nigeria	38,798	24,505	13,506	787	83,909	4,109	7,787	72,013	32	86	63	1
Rwanda	1,060	1,060	0	0	3,566	0	1,776	1,790	23	100	0	0
Senegal	4,080	2,700	1,191	189	11,591	219	669	10,702	26	92	64	2
South Africa	74,567	37,876	23,720	12,971	127,697	190	14,502	113,004	37	100	62	10
Tanzania	4,330	3,297	1,033	0	44,400	3,713	20,687	20,000	9	47	5	0
Uganda	2,331	2,331	0	0	68,591	6,840	26,751	35,000	3	25	0	0
Zambia	6,459	3,290	2,058	1,111	11,826	0	1,705	10,121	35	100	55	10
Grand Total	191,108	115,594	56,362	19,151	642,828	37,466	146,516	458,846				
Average	9,100	5,504	2,684	912	30,611	1,784	6,977	21,850	20	72	21	2
Median	4,540	3,113	903	189	19,869	821	4,466	12,194	20	76	13	1

## ROADS IN SUB-SAHARAN AFRICA: CROSS-COUNTRY ANNEX

	Paved network length in km				Unpaved network length in km				Paved length by network type (%)			
	Classified	Primary	Secondary	Tertiary	Classified	Primary	Secondary	Tertiary	Classified	Primary	Secondary	Tertiary
Subregion												
Central Africa	6,586	5,081	981	523	49,859	8,881	11,855	29,123	15	55	6	1
Eastern Africa	19,342	13,547	4,758	1,036	177,888	13,118	65,290	99,480	12	56	8	1
Southern Africa	101,857	55,573	31,034	15,250	237,246	2,907	42,737	191,602	24	86	28	4
Western Africa	63,324	41,393	19,589	2,343	177,835	12,560	26,634	138,641	23	73	28	1
Country income group												
Low income	104,929	69,581	29,927	5,422	452,769	33,795	115,974	303,001	20	70	20	2
Lower middle income	11,612	8,138	2,716	759	62,362	3,481	16,039	42,841	17	69	14	2
Upper middle income	74,567	37,876	23,720	12,971	127,697	190	14,502	113,004	37	100	62	10
Country income and dependency status												
Low income aid dependent	65,145	44,167	16,343	4,635	341,608	23,530	102,374	215,704	20	73	18	2
Low income resource dependent	44,324	28,527	14,487	1,310	130,202	12,990	17,866	99,346	18	51	27	2
Middle income	81,639	42,901	25,532	13,207	171,017	946	26,276	143,795	23	85	29	4
Country geography												
Coastal	160,165	91,815	51,124	17,226	458,221	17,073	88,414	352,734	21	76	30	3
Island	5,045	2,537	2,142	366	20,596	454	4,466	15,676	20	85	32	2
Landlocked	25,898	21,243	3,096	1,559	164,010	19,939	53,636	90,436	19	64	9	2
Predominant terrain and climate												
Flat and arid	169,389	99,089	52,448	17,852	500,568	25,032	97,144	378,393	21	73	26	2
Rolling and humid	21,719	16,506	3,914	1,299	142,259	12,434	49,372	80,453	19	68	11	2
Road sector institutions												
Road fund and road agency	27,365	17,783	7,710	1,872	152,906	7,792	45,994	99,119	17	72	17	2
Road fund only	46,298	32,730	10,236	3,332	266,726	25,155	77,562	164,008	19	67	13	2
Road agency only	78,647	40,576	24,910	13,160	139,287	410	15,172	123,706	31	96	63	6
No road fund or agency	38,798	24,505	13,506	787	83,909	4,109	7,787	72,013	32	86	63	1
Fuel levy												
High	34,278	23,775	8,241	2,262	218,180	15,827	63,081	139,271	14	64	12	2
Low	34,385	21,767	9,682	2,936	120,328	6,215	30,222	83,891	23	79	19	2
No	122,446	70,052	38,439	13,954	304,320	15,424	53,212	235,684	23	68	38	3

Sources: AICD RNET outputs from Alberto Nogales, July 2008. Based on AICD Study inputs on road length, type, condition, traffic, and road works costs (year 2007).

## 5 Condition of classified road network by network type

	Classified Network			Primary Network			Secondary Network			Tertiary Network		
	Good	Fair	Poor	Good	Fair	Poor	Good	Fair	Poor	Good	Fair	Poor
Benin	21	46	32	33	25	43	7	74	18	23	43	34
Burkina Faso	70	21	9	75	21	4	72	11	17	63	28	9
Cameroon	36	27	37	42	26	32	39	28	34	32	26	41
Chad	36	27	37	35	43	22	28	27	44	39	20	40
Cote d'Ivoire	18	56	26	16	63	21	4	91	5	29	30	41
Ethiopia	38	28	34	61	25	15	28	38	34	32	25	43
Ghana	49	35	17	45	37	18	41	29	30	51	36	13
Kenya	50	16	34	51	31	18	51	23	26	49	11	40
Lesotho	26	30	43	19	39	42	25	32	43	31	24	45
Madagascar	20	14	66	64	22	14	25	31	44	10	5	85
Malawi	41	48	12	43	47	11	39	51	11	44	42	14
Mozambique	27	34	39	58	30	12	26	52	21	19	31	50
Namibia	38	30	32	56	36	8	44	42	14	33	25	43
Niger	36	31	33	47	42	12	33	33	34	31	24	45
Nigeria	32	32	36	38	37	24	14	38	48	35	29	37
Rwanda	12	19	69	41	48	11	7	21	73	0	0	100
Senegal	24	18	58	33	12	55	26	26	48	21	18	61
South Africa	42	23	35	90	8	2	31	34	35	31	24	45
Tanzania	34	37	29	59	32	9	30	51	20	31	24	45
Uganda	2	27	71	14	73	13	0	11	89	0	29	71
Zambia	26	26	48	55	16	29	31	21	48	16	30	54
Average	32	30	38	46	34	20	29	36	35	30	25	46
Median	34	28	35	45	32	15	28	32	34	31	25	43

## ROADS IN SUB-SAHARAN AFRICA: CROSS-COUNTRY ANNEX

Average of values	Classified Network			Primary Network			Secondary Network			Tertiary Network		
	Good	Fair	Poor	Good	Fair	Poor	Good	Fair	Poor	Good	Fair	Poor
Subregion												
Central Africa	28	24	48	39	39	22	25	25	50	24	16	61
Eastern Africa	31	27	42	46	40	14	27	30	43	28	22	50
Southern Africa	31	29	39	55	28	17	32	38	31	26	26	48
Western Africa	36	34	30	41	34	25	28	43	29	36	30	34
Country income group												
Low income	32	30	38	45	35	19	27	37	36	29	25	46
Lower middle income	33	29	37	39	34	27	36	34	30	32	25	43
Upper middle income	42	23	35	90	8	2	31	34	35	31	24	45
Country income and dependency status												
Low income aid dependent	31	30	38	46	35	19	28	37	35	28	25	47
Low income resource dependent	35	29	37	38	36	26	27	31	42	35	25	39
Middle income	35	28	37	55	28	17	33	36	31	32	24	44
Country geography												
Coastal	34	32	34	47	31	22	28	44	27	32	27	41
Island	20	14	66	64	22	14	25	31	44	10	5	85
Landlocked	32	29	40	43	39	18	29	27	44	28	25	47
Predominant terrain and climate												
Flat and arid	36	31	33	49	31	20	31	39	29	34	27	40
Rolling and humid	25	28	47	41	40	20	23	30	47	21	22	57
Road sector institutions												
Road fund and road agency	36	37	27	47	39	14	29	50	21	35	28	37
Road fund only	31	28	41	44	35	20	29	32	39	27	24	48
Road agency only	33	20	47	61	10	28	28	30	42	26	21	53
No road fund or agency	32	32	36	38	37	24	14	38	48	35	29	37
Fuel levy												
High	37	29	34	52	32	17	35	37	28	34	23	43
Low	28	34	39	40	37	22	24	43	34	26	26	48
None	34	24	42	50	30	20	29	24	48	30	25	45

Sources: AICD RNET outputs from Alberto Nogales, July 2008. Based on AICD Study inputs on road length, type, condition, traffic, and road works costs (year 2007).

## 6 Condition of classified road network by surface class

	Classified Network			Paved Network			Unpaved Network		
	Good	Fair	Poor	Good	Fair	Poor	Good	Fair	Poor
Benin	21	46	32	33	17	50	18	55	27
Burkina Faso	70	21	9	67	30	4	71	19	10
Cameroon	36	27	37	37	16	48	36	29	35
Chad	36	27	37	81	7	13	34	28	38
Cote d'Ivoire	18	56	26	17	63	20	19	54	28
Ethiopia	38	28	34	66	22	12	30	30	40
Ghana	49	35	17	66	29	5	45	36	19
Kenya	50	16	34	47	37	17	50	13	37
Lesotho	26	30	43	23	42	35	27	28	46
Madagascar	20	14	66	52	23	25	12	12	77
Malawi	41	48	12	47	38	15	39	50	11
Mozambique	27	34	39	51	33	16	21	35	44
Namibia	38	30	32	57	36	7	35	30	35
Niger	36	31	33	49	40	11	32	27	42
Nigeria	32	32	36	36	31	33	30	33	37
Rwanda	12	19	69	41	48	11	3	10	86
Senegal	24	18	58	34	18	48	21	17	62
South Africa	42	23	35	61	19	20	31	25	44
Tanzania	34	37	29	70	25	5	31	38	31
Uganda	2	27	71	18	73	9	1	26	73
Zambia	26	26	48	47	14	38	14	32	54
Average	32	30	38	48	31	21	29	30	42
Median	34	28	35	47	30	16	30	29	38



## ROADS IN SUB-SAHARAN AFRICA: CROSS-COUNTRY ANNEX

Average of values	Classified Network			Paved Network			Unpaved Network		
	Good	Fair	Poor	Good	Fair	Poor	Good	Fair	Poor
Subregion									
Central	28	24	48	53	23	24	25	23	53
Eastern	31	27	42	50	39	11	28	27	45
Southern	31	29	39	48	29	22	26	30	44
Western	36	34	30	43	32	24	34	34	32
Country income group									
Low income	32	30	38	48	32	19	28	30	42
Lower middle income	33	29	37	39	31	30	33	29	39
Upper middle income	42	23	35	61	19	20	31	25	44
Country income and dependency status									
Low income aid dependent	31	30	38	47	34	19	27	30	43
Low income resource dependent	35	29	37	51	18	31	33	30	37
Middle income	35	28	37	47	32	21	31	27	42
Country geography									
Coastal	34	32	34	46	29	24	31	33	36
Island	20	14	66	52	23	25	12	12	77
Landlocked	32	29	40	49	35	16	28	28	44
Predominant terrain and climate									
Flat and arid	36	31	33	51	28	20	32	31	36
Rolling and humid	25	28	47	41	37	22	21	26	52
Road sector institutions									
Road fund and road agency	36	37	27	55	35	10	32	37	31
Road fund only	31	28	41	46	32	22	28	28	44
Road agency only	33	20	47	47	19	34	26	21	53
No road fund or agency	32	32	36	36	31	33	30	33	37
Fuel levy									
High	37	29	34	58	25	17	34	29	37
Low	28	34	39	42	35	23	23	34	43
None	34	24	42	43	34	23	31	24	45

Sources: AICD RONET outputs from Alberto Nogales, July 2008. Based on AICD Study inputs on road length, type, condition, traffic, and road works costs (year 2007).

## 7 Average daily traffic on annual basis

	Classified	Classified Network			Paved	Unpaved
	Network	Primary	Secondary	Tertiary	Network	Network
Benin	489	1,618	77	10	2,035	57
Burkina Faso	170	339	47	29	722	52
Cameroon	286	879	239	30	1,099	92
Chad	45	143	32	5	519	28
Cote d'Ivoire	224	682	212	16	843	47
Ethiopia	192	474	142	85	499	101
Ghana	250	1,855	262	50	1,314	40
Kenya	188	1,156	207	24	1,108	38
Lesotho	546	1,350	497	59	2,175	148
Madagascar	178	854	276	12	827	19
Malawi	170	519	59	26	601	45
Mozambique	215	905	147	58	888	52
Namibia	191	1,329	173	28	1,147	43
Niger	133	359	59	31	387	38
Nigeria	597	1,990	680	26	1,772	54
Rwanda	241	867	106	5	867	55
Senegal	272	1,089	360	37	945	35
South Africa	1,066	5,469	117	24	2,883	5
Tanzania	251	1,057	217	5	1,797	100
Uganda	111	747	35	2	2,063	44
Zambia	289	1,224	180	52	737	45
Average	291	1,186	196	29	1,201	54
Median	224	905	173	26	945	45

## ROADS IN SUB-SAHARAN AFRICA: CROSS-COUNTRY ANNEX

Average of values	Classified Network	Classified Network			Paved Network	Unpaved Network
		Primary	Secondary	Tertiary		
Subregion						
Central	191	629	126	13	828	59
Eastern	185	859	150	29	1,367	71
Southern	379	1,664	207	37	1,323	51
Western	305	1,133	243	28	1,146	46
Country income group						
Low income	236	934	182	28	1,054	50
Lower middle income	341	1,186	303	39	1,474	95
Upper middle income	1,066	5,469	117	24	2,883	5
Country income and dependency status						
Low income aid dependent	225	916	159	29	1,042	51
Low income resource dependent	310	1,004	317	21	1,130	58
Middle income	601	2,716	262	37	2,068	65
Country geography						
Coastal	366	1,639	245	28	1,439	51
Island	178	854	276	12	827	19
Landlocked	211	669	128	33	952	62
Predominant terrain and climate						
Flat and arid	313	1,373	198	28	1,221	45
Rolling and humid	246	813	193	31	1,162	72
Road sector institutions						
Road fund and road agency	221	1,079	201	37	1,120	66
Road fund only	236	843	151	26	1,079	55
Road agency only	669	3,279	239	30	1,914	20
No road fund or agency	597	1,990	680	26	1,772	54
Fuel levy						
High	195	849	165	34	1,008	65
Low	280	1,036	192	29	1,087	55
None	443	1,927	248	24	1,677	38

Sources: AICD RNET outputs from Alberto Nogales, July 2008. Based on AICD Study inputs on road length, type, condition, traffic, and road works costs (year 2007).

## 8 Motorized vehicle utilization

Millions of vehicle kilometers annually

	Total	Classified road network			Total	Total	Classified road network	
	Classified	Primary	Secondary	Tertiary	Unclassified	Network	million pass-km	million ton-km
Benin	1,488	1,409	66	13	13	1,501	7,097	2,876
Burkina Faso	943	831	60	52	13	956	4,342	1,707
Cameroon	2,463	1,872	451	140	18	2,481	11,556	4,615
Chad	465	369	69	28	9	474	2,094	814
Cote d'Ivoire	2,089	1,433	585	72	1	2,090	9,727	3,859
Ethiopia	1,443	857	246	340	45	1,488	6,612	2,592
Ghana	3,669	2,413	729	527	4	3,673	17,274	6,938
Kenya	3,901	2,335	1,269	298	11	3,913	18,269	7,306
Lesotho	1,057	731	276	50	1	1,058	5,072	2,068
Madagascar	1,666	932	666	68	7	1,673	7,874	3,173
Malawi	826	652	144	30	4	830	3,805	1,497
Mozambique	2,295	1,622	263	410	33	2,328	10,674	4,236
Namibia	3,145	2,084	762	298	33	3,177	14,807	5,949
Niger	652	526	44	82	6	658	2,977	1,162
Nigeria	26,759	20,779	5,283	698	65	26,824	127,536	51,674
Rwanda	407	335	68	3	17	424	1,893	750
Senegal	1,554	1,161	245	149	4	1,559	7,284	2,907
South Africa	78,699	75,988	1,628	1,082	291	78,990	383,141	158,175
Tanzania	4,458	2,703	1,718	37	10	4,468	21,005	8,427
Uganda	2,867	2,501	340	26	9	2,876	13,474	5,410
Zambia	1,932	1,469	247	215	34	1,966	9,128	3,676
Grand Total	142,778	123,003	15,160	4,616	629	143,408	685,642	279,811
Average	6,799	5,857	722	220	30	6,829	32,650	13,324
Median	1,932	1,433	276	82	11	1,966	9,128	3,676

## ROADS IN SUB-SAHARAN AFRICA: CROSS-COUNTRY ANNEX

Sum of values	Classified road network				Total Unclassified	Total Network	Classified road network	
	Total Classified	Primary	Secondary	Tertiary			million pass-km	million ton- km
Subregion								
Central	3,335	2,577	588	171	44	3,379	15,542	6,179
Eastern	12,670	8,396	3,574	699	76	12,745	59,360	23,734
Southern	89,619	83,480	3,986	2,153	403	90,022	434,502	178,775
Western	37,155	28,550	7,012	1,592	106	37,261	176,238	71,122
Country income group								
Low income	57,415	42,327	12,042	3,046	287	57,701	271,066	109,003
Lower middle income	6,665	4,688	1,489	488	51	6,716	31,435	12,632
Upper middle income	78,699	75,988	1,628	1,082	291	78,990	383,141	158,175
Country income and dependency status								
Low income aid dependent	30,191	21,179	6,691	2,321	213	30,403	141,436	56,516
Low income resource dependent	29,688	23,020	5,803	865	92	29,779	141,185	57,103
Middle income	82,900	78,804	2,666	1,430	325	83,225	403,020	166,192
Country geography								
Coastal	130,521	113,799	12,999	3,723	484	131,004	628,371	256,963
Island	1,666	932	666	68	7	1,673	7,874	3,173
Landlocked	10,591	8,272	1,495	825	139	10,730	49,396	19,675
Predominant terrain and climate								
Flat and arid	132,049	115,122	12,968	3,960	528	132,578	635,356	259,706
Rolling and humid	10,729	7,881	2,192	656	101	10,830	50,286	20,105
Road sector institutions								
Road fund and road agency	14,804	9,491	4,040	1,273	93	14,897	69,426	27,765
Road fund only	20,962	15,585	3,963	1,414	176	21,138	98,254	39,290
Road agency only	80,253	77,149	1,873	1,231	296	80,549	390,426	161,082
No road fund or agency	26,759	20,779	5,283	698	65	26,824	127,536	51,674
Fuel levy								
High	18,171	11,843	4,778	1,550	159	18,330	85,017	33,939
Low	13,785	9,900	2,825	1,060	88	13,873	64,847	25,999
None	110,822	101,260	7,556	2,006	382	111,204	535,777	219,872

Sources: AICD RNET outputs from Alberto Nogales, July 2008. Based on AICD Study inputs on road length, type, condition, traffic, and road works costs (year 2007).

## 9 Distribution of vehicle use

	Distribution of vehicle utilization of classified road network					% Unclassified of Total Network
	% Primary	% Secondary	% Tertiary	% paved	% unpaved	
Benin	95	4	1	91	9	0.9
Burkina Faso	88	6	6	75	25	1.3
Cameroon	76	18	6	74	26	0.7
Chad	79	15	6	40	60	2.0
Cote d'Ivoire	69	28	3	84	16	0.0
Ethiopia	59	17	24	59	41	3.0
Ghana	66	20	14	86	14	0.1
Kenya	60	33	8	83	17	0.3
Lesotho	69	26	5	78	22	0.1
Madagascar	56	40	4	91	9	0.4
Malawi	79	17	4	80	20	0.5
Mozambique	71	11	18	81	19	1.4
Namibia	66	24	9	80	20	1.0
Niger	81	7	13	79	21	1.0
Nigeria	78	20	3	94	6	0.2
Rwanda	82	17	1	82	18	4.0
Senegal	75	16	10	91	9	0.3
South Africa	97	2	1	100	0	0.4
Tanzania	61	39	1	64	36	0.2
Uganda	87	12	1	61	39	0.3
Zambia	76	13	11	90	10	1.7
Average	75	18	7	79	21	0.4
Median	76	17	6	81	19	0.5

## ROADS IN SUB-SAHARAN AFRICA: CROSS-COUNTRY ANNEX

Average of values	Distribution of vehicle utilization of classified road network					% Unclassified of Total Network
	% Primary	% Secondary	% Tertiary	% paved	% unpaved	
Subregion						
Central	79	17	4	65	35	1.3
Eastern	67	25	8	67	33	0.6
Southern	73	19	7	86	14	0.4
Western	79	14	7	86	14	0.3
Country income group						
Low income	74	18	7	78	22	0.5
Lower middle income	70	23	7	77	23	0.8
Upper middle income	97	2	1	100	0	0.4
Country income and dependency status						
Low income aid dependent	74	19	8	80	20	0.7
Low income resource dependent	78	18	5	69	31	0.3
Middle income	77	17	5	86	14	0.4
Country geography						
Coastal	74	20	7	84	16	0.4
Island	56	40	4	91	9	0.4
Landlocked	78	14	8	72	28	1.3
Predominant terrain and climate						
Flat and arid	76	17	7	81	19	0.4
Rolling and humid	73	21	6	75	25	0.9
Road sector institutions						
Road fund and road agency	64	26	10	75	25	0.6
Road fund only	77	17	6	77	23	0.8
Road agency only	86	9	5	95	5	0.4
No road fund or agency	78	20	3	94	6	0.2
Fuel levy						
High	67	22	10	69	31	0.9
Low	75	19	6	85	15	0.6
None	85	11	4	84	16	0.3

Sources: AICD RONET outputs from Alberto Nogales, July 2008. Based on AICD Study inputs on road length, type, condition, traffic, and road works costs (year 2007).

## 10 Use of classified road network by surface class and traffic level

	Unpaved Road Network Utilization by Traffic Level					Paved Road Network Utilization by Traffic Level				
	Level I	Level II	Level III	Level IV	Level V	Level I	Level II	Level III	Level IV	Level V
	(0-10 AADT)	(10-30 AADT)	(30-100 AADT)	(100-300 AADT)	(300-1000 AADT)	(100-300 AADT)	(300-1000 AADT)	(1000- 3000 AADT)	(3000- 10000 AADT)	(>10000 AADT)
Benin	1	0	11	52	36	1	10	35	43	11
Burkina Faso	9	36	46	7	1	6	40	54	0	0
Cameroon	4	0	3	31	62	5	17	40	37	0
Chad	16	7	48	24	6	8	79	13	0	0
Cote d'Ivoire	7	2	26	33	32	5	29	55	10	0
Ethiopia	12	5	33	40	10	14	58	29	0	0
Ghana	22	50	27	0	0	2	23	21	45	8
Kenya	19	18	32	25	6	6	13	44	37	0
Lesotho	1	13	26	23	38	3	7	6	40	44
Madagascar	19	48	33	0	0	11	26	11	24	28
Malawi	3	48	33	16	0	8	47	45	0	0
Mozambique	6	55	25	14	0	8	15	61	13	3
Namibia	4	46	32	9	9	6	16	19	42	17
Niger	18	28	33	12	9	21	65	14	0	0
Nigeria	5	7	47	18	22	1	13	34	37	15
Rwanda	6	2	9	49	34	5	26	68	0	0
Senegal	11	0	21	62	7	4	25	51	21	0
South Africa	100	0	0	0	0	4	1	9	32	54
Tanzania	2	14	32	33	19	1	14	22	39	24
Uganda	6	11	28	32	23	1	12	21	52	14
Zambia	3	48	20	29	0	15	18	15	45	7
Average	13	21	27	24	15	6	26	32	25	11
Median	6	13	28	24	9	5	18	29	32	3



## ROADS IN SUB-SAHARAN AFRICA: CROSS-COUNTRY ANNEX

Average of values	Unpaved Road Network Utilization by Traffic Level					Paved Road Network Utilization by Traffic Level				
	Level I	Level II	Level III	Level IV	Level V	Level I	Level II	Level III	Level IV	Level V
Subregion										
Central	9	3	20	35	34	6	41	40	12	0
Eastern	10	12	31	33	14	5	24	29	32	10
Southern	19	37	24	13	7	8	19	24	28	22
Western	11	18	30	26	15	6	29	38	22	5
Country income group										
Low income	10	22	30	26	12	7	30	35	21	7
Lower middle income	3	20	20	21	36	5	13	21	40	20
Upper middle income	100	0	0	0	0	4	1	9	32	54
Country income and dependency status										
Low income aid dependent	10	24	27	27	12	7	28	36	22	6
Low income resource dependent	8	5	33	24	30	5	36	29	25	5
Middle income	35	20	19	11	16	4	8	11	38	39
Country geography										
Coastal	17	18	23	25	17	4	16	36	32	12
Island	19	48	33	0	0	11	26	11	24	28
Landlocked	8	22	31	26	13	9	39	29	15	7
Predominant terrain and climate										
Flat and arid	16	22	29	23	10	6	26	32	26	10
Rolling and humid	7	18	24	27	24	7	28	31	22	12
Road sector institutions										
Road fund and road agency	9	23	30	23	14	6	28	29	27	10
Road fund only	9	24	27	24	17	8	29	33	22	8
Road agency only	56	0	10	31	3	4	13	30	26	27
No road fund or agency	5	7	47	18	22	1	13	34	37	15
Fuel levy										
High	9	21	29	25	16	7	30	33	24	6
Low	9	27	24	24	17	8	28	30	23	11
None	26	11	28	24	11	3	18	34	28	17

Sources: AICD RNET outputs from Alberto Nogales, July 2008. Based on AICD Study inputs on road length, type, condition, traffic, and road works costs (year 2007).

## 11 Selected standards by network type, surface class, and traffic level

	% of paved roads in the primary network with 10,000 AADT or more	% of paved roads in the primary network with 300 AADT or less	% unpaved roads in the primary network with 300 AADT or more	% of paved roads in the secondary network with 300 AADT or less	% unpaved roads in the secondary network with 300 AADT or more	% unpaved roads in tertiary network with 30 AADT or less
Benin	2	10	34	0	2	95
Burkina Faso	0	26	1	45	1	74
Cameroon	0	16	36	49	18	94
Chad	0	25	0	0	1	100
Cote d'Ivoire	0	24	3	30	7	93
Ethiopia	0	32	40	0	6	74
Ghana	2	13	0	26	0	72
Kenya	0	26	3	37	4	89
Lesotho	10	44	18	27	18	65
Madagascar	1	37	0	60	0	97
Malawi	0	22	13	87	0	81
Mozambique	0	34	7	72	2	53
Namibia	2	27	0	73	1	82
Niger	0	53	24	0	0	73
Nigeria	3	5	27	23	20	90
Rwanda	0	31	0	0	6	100
Senegal	0	9	0	34	0	77
South Africa	20	11	0	100	0	100
Tanzania	2	10	27	25	10	100
Uganda	4	12	26	0	0	100
Zambia	2	41	0	86	6	80
Average	2	24	14	43	5	85
Median	0	25	3	30	2	89

## ROADS IN SUB-SAHARAN AFRICA: CROSS-COUNTRY ANNEX

Average of values	Primary			Secondary		Tertiary
	% of paved roads in the primary network with 10,000 AADT or more	% of paved roads in the primary network with 300 AADT or less	% unpaved roads in the primary network with 300 AADT or more	% of paved roads in the secondary network with 300 AADT or less	% unpaved roads in the secondary network with 300 AADT or more	% unpaved roads in tertiary network with 30 AADT or less
<b>Subregion</b>						
Central	0	24	18	24	9	98
Eastern	1	20	24	21	5	91
Southern	5	31	6	72	4	80
Western	1	20	13	26	4	82
<b>Country income group</b>						
Low income	1	24	14	37	4	85
Lower middle income	4	29	18	50	13	80
Upper middle income	20	11	0	100	0	100
<b>Country income and dependency status</b>						
Low income aid dependent	1	25	14	42	3	84
Low income resource dependent	1	15	21	24	13	95
Middle income	11	27	6	67	7	82
<b>Country geography</b>						
Coastal	3	17	12	47	6	86
Island	1	37	0	60	0	97
Landlocked	2	32	17	35	4	83
<b>Predominant terrain and climate</b>						
Flat and arid	2	22	10	42	4	84
Rolling and humid	2	28	22	45	7	87
<b>Road sector institutions</b>						
Road fund and road agency	1	21	14	31	5	84
Road fund only	2	29	15	46	4	85
Road agency only	10	10	0	67	0	89
No road fund or agency	3	5	27	23	20	90
<b>Fuel levy</b>						
High	1	24	16	37	6	84
Low	2	31	13	45	4	84
None	5	12	11	50	4	88

Sources: AICD RONET outputs from Alberto Nogales, July 2008. Based on AICD Study inputs on road length, type, condition, traffic, and road works costs (year 2007).

## 12 Upgrading and widening requirements

Kilometers

	Earth roads length with more than 30 AADT	Gravel roads length with more than 300 AADT	Surface treatment roads length with more than 3,000 AADT	Asphalt mix roads length with more than 10,000 AADT
Benin	1,829	0	0	24
Burkina Faso	946	54	0	0
Cameroon	5,717	0	0	0
Chad	1,865	19	0	0
Cote d'Ivoire	6,162	0	0	0
Ethiopia	538	1,172	0	0
Ghana	0	0	0	0
Kenya	3,955	478	153	0
Lesotho	0	456	0	78
Madagascar	146	0	0	63
Malawi	0	121	0	0
Mozambique	2,667	238	43	8
Namibia	1,115	313	0	0
Niger	775	48	0	0
Nigeria	11,193	1,502	116	599
Rwanda	1,066	0	0	0
Senegal	2,674	0	160	0
South Africa	0	0	0	6,745
Tanzania	175	3,023	0	98
Uganda	5,622	1,779	0	45
Zambia	0	258	0	17
Grand Total	46,446	9,461	471	7,678

## ROADS IN SUB-SAHARAN AFRICA: CROSS-COUNTRY ANNEX

Sum of values	Unpaved		Paved	
	Earth roads length with more than 30 AADT	Gravel roads length with more than 300 AADT	Surface treatment roads length with more than 3,000 AADT	Asphalt mix roads length with more than 10,000 AADT
<b>Subregion</b>				
Central	8,648	19	0	0
Eastern	10,290	6,452	153	143
Southern	3,928	1,387	43	6,912
Western	23,579	1,603	276	623
<b>Country income group</b>				
Low income	39,614	8,691	471	855
Lower middle income	6,832	769	0	78
Upper middle income	0	0	0	6,745
<b>Country income and dependency status</b>				
Low income aid dependent	26,556	7,171	355	256
Low income resource dependent	18,775	1,520	116	599
Middle income	1,115	769	0	6,823
<b>Country geography</b>				
Coastal	35,487	5,554	471	7,474
Island	146	0	0	63
Landlocked	10,812	3,907	0	140
<b>Predominant terrain and climate</b>				
Flat and arid	33,356	5,932	471	7,491
Rolling and humid	13,090	3,529	0	186
<b>Road sector institutions</b>				
Road fund and road agency	7,990	4,509	0	98
Road fund only	24,589	3,450	196	236
Road agency only	2,674	0	160	6,745
No road fund or agency	11,193	1,502	116	599
<b>Fuel levy</b>				
High	16,032	5,243	196	107
Low	9,979	884	0	183
None	20,435	3,334	276	7,388

Sources: AICD RNET outputs from Alberto Nogales, July 2008. Based on AICD Study inputs on road length, type, condition, traffic, and road works costs (year 2007).

## 13 Asset value of the classified road network

US\$ millions

	Asset value road network [million US\$]				Share of classified road network							Asset value as share of	
	Classified	Primary	Secondary	Tertiary	Primary	Secondary	Tertiary	Paved	Unpaved	Primary Paved	Tertiary Unpaved	Maximum AV	GDP
Benin	708	539	84	85	76	12	12	73	27	73	12	80	15
Burkina Faso	1,561	1,206	188	168	77	12	11	63	37	62	11	92	15
Cameroon	1,664	902	382	380	54	23	23	68	32	48	17	75	9
Chad	1,168	590	224	354	51	19	30	29	71	27	30	85	18
Cote d'Ivoire	2,334	1,292	743	299	55	32	13	75	25	53	12	84	13
Ethiopia	2,293	1,558	315	420	68	14	18	73	27	66	16	85	17
Ghana	3,547	852	1,327	1,368	24	37	39	61	39	22	30	91	27
Kenya	4,307	1,374	1,780	1,153	32	41	27	59	41	30	23	87	20
Lesotho	449	269	118	62	60	26	14	66	34	54	14	75	30
Madagascar	2,017	886	792	339	44	39	17	76	24	43	14	80	37
Malawi	1,428	862	464	103	60	32	7	67	33	57	6	90	64
Mozambique	2,610	1,501	474	635	58	18	24	71	29	56	21	86	34
Namibia	3,291	1,424	1,102	764	43	33	23	61	39	43	22	88	52
Niger	1,503	1,182	116	205	79	8	14	79	21	77	13	88	42
Nigeria	14,236	8,460	3,901	1,876	59	27	13	84	16	58	12	79	12
Rwanda	441	355	50	36	80	11	8	80	20	80	8	88	18
Senegal	1,259	669	345	245	53	27	19	82	18	53	17	71	14
South Africa	26,453	14,219	7,240	4,994	54	27	19	88	12	54	10	88	10
Tanzania	3,251	1,380	1,417	454	42	44	14	46	54	36	14	87	25
Uganda	2,507	1,113	726	668	44	29	27	30	70	30	27	70	27
Zambia	2,041	996	597	447	49	29	22	85	15	49	12	77	19
Total	79,070	41,629	22,385	15,055									
Average	3,765	1,982	1,066	717	55	26	19	68	32	51	16	83	25
Median	2,041	1,113	474	380	54	27	18	71	29	53	14	85	19

## ROADS IN SUB-SAHARAN AFRICA: CROSS-COUNTRY ANNEX

Total/Averages	Asset value road network (million US\$)						Share of classified road network					Asset value as share of	
	Classified	Primary	Secondary	Tertiary	Primary	Secondary	Tertiary	Paved	Unpaved	Primary Paved	Tertiary Unpaved	Maximum AV	GDP
Subregion													
Central	3,274	1,847	655	771	62	18	20	59	41	52	18	83	15
Eastern	12,358	5,425	4,239	2,695	47	32	21	52	48	41	20	82	22
Southern	38,289	20,157	10,786	7,345	52	29	18	73	27	51	14	83	35
Western	25,149	14,200	6,704	4,245	61	22	17	74	26	57	15	83	20
Country income group													
Low income	47,213	24,815	13,544	8,854	56	25	19	67	33	51	16	83	25
Lower middle income	5,404	2,595	1,601	1,207	52	28	20	65	35	48	17	80	30
Upper middle income	26,453	14,219	7,240	4,994	54	27	19	88	12	54	10	88	10
Country income and dependency status													
Low income aid dependent	31,808	15,764	9,419	6,624	56	26	18	68	32	52	16	84	26
Low income resource dependent	17,069	9,953	4,506	2,610	55	23	22	60	40	44	20	80	13
Middle income	30,193	15,912	8,460	5,821	52	29	19	72	28	50	15	84	31
Country geography													
Coastal	63,661	32,613	18,795	12,253	50	29	21	70	30	48	17	83	21
Island	2,017	886	792	339	44	39	17	76	24	43	14	80	37
Landlocked	13,392	8,130	2,798	2,463	63	20	17	64	36	56	15	83	28
Predominant terrain and climate													
Flat and arid	4,876	2,549	1,396	932	54	26	20	68	32	49	17	84	23
Rolling and humid	1,543	849	407	287	59	25	16	66	34	54	15	80	29
Road sector institutions													
Road fund and road agency	14,716	6,507	4,904	3,305	47	32	21	63	37	44	19	87	27
Road fund only	22,405	11,774	5,995	4,636	59	23	18	65	35	53	16	83	27
Road agency only	27,712	14,888	7,585	5,238	53	27	19	85	15	53	13	79	12
No road fund or agency	14,236	8,460	3,901	1,876	59	27	13	84	16	58	12	79	12
Fuel levy													
High	18,585	8,730	5,694	4,161	50	27	23	58	42	44	20	85	25
Low	14,468	7,232	4,291	2,945	59	25	16	74	26	56	14	84	30
None	46,016	25,667	12,400	7,950	58	25	18	69	31	51	15	80	16

Sources: AICD RONET outputs from Alberto Nogales, July 2008. Based on AICD Study inputs on road length, type, condition, traffic, and road works costs (year 2007).

## 14 Preservation requirements over a 20-year period

US\$ millions, custom standard

	20 year	Average	Average Annual		Road	Maintenance	
	Total	Annual	Years 1-5	Years 6-20	Rehab.	Periodic	Recurrent
Benin	619	31	63	20	19	5	6
Burkina Faso	1,066	53	64	50	3	35	15
Cameroon	1,347	67	145	41	42	11	15
Chad	683	34	53	28	11	11	12
Cote d'Ivoire	1,651	83	132	66	35	30	18
Ethiopia	1,742	87	124	75	16	51	20
Ghana	2,266	113	132	107	37	49	27
Kenya	2,934	147	202	128	51	57	39
Lesotho	475	24	42	18	10	9	5
Madagascar	1,443	72	128	54	37	17	18
Malawi	929	46	54	44	16	15	16
Mozambique	1,743	87	126	74	38	28	21
Namibia	1,988	99	122	92	34	35	30
Niger	956	48	62	43	22	13	12
Nigeria	11,234	562	1,077	390	239	216	107
Rwanda	256	13	17	11	7	2	4
Senegal	1,157	58	133	33	39	8	11
South Africa	14,347	717	1,136	578	361	179	178
Tanzania	2,613	131	148	125	32	55	44
Uganda	2,769	138	257	99	59	41	38
Zambia	1,686	84	170	56	51	16	17
Grand Total	53,907	2,695	4,389	2,131	1,159	883	653
Average	2,567	128	209	101	55	42	31
Median	1,651	83	128	56	35	28	18



## ROADS IN SUB-SAHARAN AFRICA: CROSS-COUNTRY ANNEX

Sum of values	20 year Total	Annual average	Annual average		Road Rehab.	Maintenance	
			Years 1-5	Years 6-20		Periodic	Recurrent
Subregion							
Central	2,286	114	216	81	60	24	31
Eastern	10,059	503	731	427	158	204	141
Southern	22,612	1,131	1778	915	547	299	285
Western	18,950	947	1664	709	395	356	197
Country income group							
Low income	35,749	1,787	2943	1402	712	650	425
Lower middle income	3,811	191	309	151	86	54	50
Upper middle income	14,347	717	1136	578	361	179	178
Country income and dependency status							
Low income aid dependent	23,833	1,192	1813	985	462	424	306
Low income resource dependent	13,264	663	1275	459	292	237	134
Middle income	16,810	841	1300	687	405	222	213
Country geography							
Coastal	41,900	2,095	3417	1654	928	672	495
Island	1,443	72	128	54	37	17	18
Landlocked	10,564	528	844	423	194	194	140
Predominant terrain and climate							
Flat and arid	44,945	2,247	3621	1789	973	737	537
Rolling and humid	8,962	448	767	342	186	146	116
Road sector institutions							
Road fund and road agency	10,261	513	658	465	154	220	139
Road fund only	16,909	845	1385	666	366	261	219
Road agency only	15,504	775	1270	610	400	186	188
No road fund or agency	11,234	562	1077	390	239	216	107
Fuel levy							
High	13,051	653	920	563	225	248	180
Low	10,283	514	801	419	234	157	124
None	30,573	1,529	2667	1149	701	479	349

Sources: AICD RONET outputs from Alberto Nogales, July 2008. Based on AICD Study inputs on road length, type, condition, traffic, and road works costs (year 2007).

## 15 Preservation requirements

Custom standard							
15	Annual Req. as % of GDP	Road Rehab.	Maintenance		Distribution by Network Type		
			Periodic	Recurrent	Primary	Secondary	Tertiary
Benin	0.6	63	17	20	90	7	3
Burkina Faso	0.5	6	66	28	80	14	5
Cameroon	0.4	62	16	22	67	23	10
Chad	0.5	33	31	36	65	23	11
Cote d'Ivoire	0.5	42	36	22	67	29	4
Ethiopia	0.7	19	58	23	54	23	23
Ghana	0.9	33	43	24	27	44	30
Kenya	0.7	35	39	26	33	50	17
Lesotho	1.6	41	37	22	58	34	8
Madagascar	1.3	52	24	25	34	51	15
Malawi	2.1	34	32	34	55	40	4
Mozambique	1.1	44	32	24	53	22	25
Namibia	1.6	34	35	30	40	45	15
Niger	1.3	47	27	26	75	13	12
Nigeria	0.5	43	38	19	59	37	4
Rwanda	0.5	52	19	29	81	18	1
Senegal	0.6	68	14	19	63	26	11
South Africa	0.3	50	25	25	42	40	18
Tanzania	1.0	24	42	33	36	60	4
Uganda	1.5	42	30	28	41	48	11
Zambia	0.8	60	20	20	45	37	18
Average	0.9	42	32	26	56	33	12
Median	0.7	42	32	25	55	34	11

## ROADS IN SUB-SAHARAN AFRICA: CROSS-COUNTRY ANNEX

Average of values	Annual Req. as % of GDP	Road Rehab.	Maintenance		Distribution by Network Type		
			Periodic	Recurrent	Primary	Secondary	Tertiary
Subregion							
Central	0.5	49	22	29	71	21	8
Eastern	1.0	30	42	28	41	45	14
Southern	1.3	45	29	26	47	38	15
Western	0.7	43	35	23	66	24	10
Country income group							
Low income	0.9	41	33	26	56	32	12
Lower middle income	1.2	46	29	25	55	34	11
Upper middle income	0.3	50	25	25	42	40	18
Country income and dependency status							
Low income aid dependent	0.9	41	33	25	56	32	12
Low income resource dependent	0.5	46	28	26	64	28	8
Middle income	1.2	42	32	26	47	40	14
Country geography							
Coastal	0.7	45	31	24	53	35	13
Island	1.3	52	24	25	34	51	15
Landlocked	1.1	37	36	27	62	28	10
Predominant terrain and climate							
Flat and arid	0.8	42	33	25	55	32	13
Rolling and humid	1.1	43	31	26	56	34	10
Road sector institutions							
Road fund and road agency	0.9	30	43	26	45	40	15
Road fund only	1.0	44	30	26	60	29	11
Road agency only	0.5	59	19	22	53	33	14
No road fund or agency	0.5	43	38	19	59	37	4
Fuel levy							
High	0.9	36	36	28	50	35	15
Low	1.1	47	28	25	59	30	11
None	0.7	42	35	24	57	33	10

Sources: AICD RNET outputs from Alberto Nogales, July 2008. Based on AICD Study inputs on road length, type, condition, traffic, and road works costs (year 2007).

## 16 Preservation requirements by maintenance standard

US\$ millions

	Total Preservation Requirements 20-year period					Average Annual Preservation Requirements				
	Standard					Standard				
	Custom	High	Medium	Low	Optimal	Custom	High	Medium	Low	Optimal
Benin	619	649	619	533	544	31	32	31	27	27
Burkina Faso	1,066	1,093	1,034	808	729	53	55	52	40	36
Cameroon	1,347	1,449	1,380	1,178	1,156	67	72	69	59	58
Chad	683	777	729	465	470	34	39	36	23	23
Cote d'Ivoire	1,651	1,765	1,665	1,327	1,226	83	88	83	66	61
Ethiopia	1,742	1,927	1,726	1,379	1,142	87	96	86	69	57
Ghana	2,266	2,647	2,548	1,950	2,061	113	132	127	98	103
Kenya	2,934	3,315	3,226	2,401	2,459	147	166	161	120	123
Lesotho	475	512	480	378	452	24	26	24	19	23
Madagascar	1,443	1,606	1,519	1,238	951	72	80	76	62	48
Malawi	929	972	908	682	708	46	49	45	34	35
Mozambique	1,743	2,005	1,892	1,501	1,519	87	100	95	75	76
Namibia	1,988	2,256	2,153	1,633	1,709	99	113	108	82	85
Niger	956	1,032	987	798	597	48	52	49	40	30
Nigeria	11,234	12,023	10,984	9,759	9,823	562	601	549	488	491
Rwanda	256	280	268	196	171	13	14	13	10	9
Senegal	1,157	1,231	1,170	1,070	951	58	62	59	53	48
South Africa	14,347	15,593	14,746	13,329	10,756	717	780	737	666	538
Tanzania	2,613	2,874	2,671	1,913	2,462	131	144	134	96	123
Uganda	2,769	3,002	2,865	1,889	1,822	138	150	143	94	91
Zambia	1,686	1,831	1,732	1,557	1,306	84	92	87	78	65
Grand Total	53,907	58,838	55,303	45,985	43,014	2,695	2,942	2,765	2,299	2,151
Average	2,567	2,802	2,633	2,190	2,048	128	140	132	109	102
Median	1,651	1,765	1,665	1,327	1,156	83	88	83	66	58

## ROADS IN SUB-SAHARAN AFRICA: CROSS-COUNTRY ANNEX

US\$ millions										
Sum of values	Total preservation requirements 20-year period					Average annual preservation requirements				
	Standard					Standard				
	Custom	High	Medium	Low	Optimal	Custom	High	Medium	Low	Optimal
<b>Subregion</b>										
Central	2,286	2,506	2,376	1,839	1,798	114	125	119	92	90
Eastern	10,059	11,117	10,488	7,582	7,886	503	556	524	379	394
Southern	22,612	24,774	23,432	20,318	17,401	1,131	1,239	1,172	1,016	870
Western	18,950	20,441	19,007	16,245	15,930	947	1,022	950	812	797
<b>Country income group</b>										
Low income	35,749	39,028	36,543	29,467	28,941	1,787	1,951	1,827	1,473	1,447
Lower middle income	3,811	4,216	4,014	3,189	3,318	191	211	201	159	166
Upper middle income	14,347	15,593	14,746	13,329	10,756	717	780	737	666	538
<b>Country income and dependency status</b>										
Low income aid dependent	23,833	26,229	24,830	19,243	18,648	1,192	1,311	1,242	962	932
Low income resource dependent	13,264	14,248	13,093	11,402	11,449	663	712	655	570	572
Middle income	16,810	18,361	17,380	15,340	12,917	841	918	869	767	646
<b>Country geography</b>										
Coastal	41,900	45,806	43,055	36,594	34,665	2,095	2,290	2,153	1,830	1,733
Island	1,443	1,606	1,519	1,238	951	72	80	76	62	48
Landlocked	10,564	11,425	10,729	8,153	7,399	528	571	536	408	370
<b>Predominant terrain and climate</b>										
Flat and arid	44,945	49,090	46,157	39,045	36,611	2,247	2,454	2,308	1,952	1,831
Rolling and humid	8,962	9,748	9,146	6,940	6,404	448	487	457	347	320
<b>Road sector institutions</b>										
Road fund and road agency	10,261	11,469	10,763	8,202	8,600	513	573	538	410	430
Road fund only	16,909	18,521	17,640	13,625	12,885	845	926	882	681	644
Road agency only	15,504	16,825	15,916	14,399	11,706	775	841	796	720	585
No road fund or agency	11,234	12,023	10,984	9,759	9,823	562	601	549	488	491
<b>Fuel levy</b>										
High	13,051	14,602	13,777	10,470	10,918	653	730	689	524	546
Low	10,283	11,293	10,726	8,659	8,016	514	565	536	433	401
None	30,573	32,943	30,799	26,855	24,081	1,529	1,647	1,540	1,343	1,204

Sources: AICD RNET outputs from Alberto Nogales, July 2008. Based on AICD Study inputs on road length, type, condition, traffic, and road works costs (year 2007).