

SUSTAINABLE ROAD FINANCING IN DEVELOPING COUNTRIES – A PRAGMATIC COST-REVENUE MODEL

C. AMOATEY

Institute for Road & Transportation Science, University of Stuttgart, Germany

CHARLES.AMOATEY@I-U.DE

F. WEILER (Dr.)

KfW Development Bank, Frankfurt, Germany

frank.weiler@kfw.de

A. Wagner & S. Thielmann (Dr.)

German Technical Cooperation (GTZ), Eschborn, Germany

armin.wagner@gtz.de, sascha.thielmann@gtz.de

ABSTRACT

Sustainable road financing requires adequate knowledge of both road network costs and available sector funds. Due to lack of sufficient road network information, the road administration is often constrained in its ability to estimate the financial requirements of the road sector and available funds. These further imply that the performance of the road administration in meeting road sector objectives cannot be accurately measured. This paper presents a pragmatic cost-revenue model for estimating road network costs and road sector revenues. Drawing on the examples of Ghana and Namibia, the model calculates performance indicators for measuring the extent to which road users are contributing to the financing of road network life cycle costs. The findings show that while user contributions are often sufficient to cover expected maintenance costs, they are only able to finance 43% (Namibia) and 76% (Ghana) of annual network life-cycle costs. The coverage ratios are even lower when the costs of clearing existing maintenance backlogs are included. In Ghana, only 56% of road user contributions are actually allocated to the road sector. With existing network conditions, it is estimated that 1.5-3.0% and 4.5-6.0% of GDP allocation would be required for annual maintenance and network life cycle costs respectively.

1. CONCEPTS

Despite the importance of roads in the promotion of overall economic development and improvement in living conditions, efficiency of road transport systems in many developing countries is often constrained by high vehicle operation and maintenance costs due to poor road conditions. While demand for transport infrastructure continue to grow - a result of high population growth rates, urbanisation and growth in economic activities - resources for road maintenance and asset replacement continue to be a burden.

Domestic funding is generally not sufficient to cover expected road costs. The road sector continues to rely heavily on donor support for funding. In Ghana, between 1996 and 2003, donor funds constituted roughly 40% of annual road sector budgets [1]. The question here is not about the necessity of donor supports, but rather the extent to which current levels of reliance on foreign assistance are sustainable. Even though donor support might appear indispensable, it is safe - from road financing sustainability perspective - to focus on available domestic funds when assessing developing countries' efforts at preserving their road assets.

As a starting point, sustainable road financing requires a thorough awareness of both the expected network life cycle costs on one hand and corresponding available domestic

funds on the other hand. The sustainability of any road-financing plan is therefore measured by the extent to which these available domestic funds cover the expected life-cycle costs of the road network. How do we assess the balance between road network costs and available domestic funds? This paper presents a pragmatic cost-revenue model for identifying and estimating in a systematic, transparent and logical manner, all road costs and user contributions.

Firstly, road network life cycle costs are estimated from unit cost values for road construction and maintenance. Secondly, user contributions are estimated from road user charges. Finally, using these costs and revenue figures, sets of performance indicators are developed.

The cost-revenue model, developed in MS Excel, is applied to a case study on Ghana and Namibia - two Sub-Sahara African (SSA) countries, which have embarked on very ambitious road sector development programmes. A detailed road-financing plan for Ghana is presented in this paper and the results compared with Namibia.

2. THE MODEL

The model provides answers to the following questions:

- Are sufficient funds allocated to cover expected road network life-cycle costs (i.e. road maintenance and asset replacement costs)?
- To what extent do road users contribute to the financing of these network life-cycle costs?
- How can road sector performance be measured?

2.1. Network life cycle costs

As a first step to estimating funding needs, the national road network has to be classified. This is important since different unit costs can be associated with different road types. In most countries each road class is often administered by a separate road agency. Classifying the network, placing them under different road agencies, is also essential for budget allocation purposes.

The next step is to identify all road activities and estimate the financial requirements for the road sector. Typical road cost activities are routine maintenance, periodic maintenance and reconstruction or asset replacement. The classification of these cost items is based on the required frequency for the road improvement activity and the costs involved. There are additional cost items relating to road administration overheads and cost of capital. With these cost information, annual life cycle costs of the road network can be estimated. Estimation of unit cost figures for road construction and maintenance depends very much on how road projects are contracted. Where contracts are awarded on fixed price basis, the unit cost could be taken as the average per km cost of current road projects.

1.1.1 *Base Scenario*

The base scenario for network life cycle costing considers the case of “theoretically” new roads or a network in good condition. By assuming that the road network is already in good condition, the base scenario estimates the annual financial requirement for maintenance and future road asset replacement. The idea is that, supposing donors were to help a country to construct new roads or to rehabilitate its existing network, would the country be able to generate and allocate sufficient funds to meet:

- required routine and periodic road maintenance costs and

- annual asset replacement costs? That is, will the country be able to make necessary monetary savings to replace the network at the end of its economic or design life?

The base scenario aims at assessing the sustainability of donor-funded reconstruction and rehabilitation projects. Many donor-funded road projects have failed in the past because counterpart local funds required for routine or periodic maintenance are often not provided. This model will therefore assist policymakers and the road administration to estimate how much funds will be needed annually for road maintenance and replacement and also to determine if existing user contributions and allocated funds are adequate to cover expected road life-cycle costs.

In the base scenario, the life cycle costs therefore consist of annual routine maintenance, annualised future periodic maintenance and asset replacement costs. There is also provision for administrative overhead and financing cost. The model assumes an administrative cost of 5% of net total road costs and a cost of capital of 0%. With a cost of capital of 0%, we are considering the case where road costs are financed from say interest-free loans. Though this may represent a rare scenario, by excluding any possible interest payment, the results of the model present the least costs the road administration must bear irrespective of the sources of funding available to it. *Table 1* presents the road network life cycle costs for Ghana. The unit cost figures are obtained from unconstrained road budgets for year 2003 to 2005 [1].

Table 1 Annual network life cycle costs in Ghana (base scenario)

Road class	Network Size	Asset replacement costs				Routine maint. costs		Periodic maintenance costs			Total maint	Annual life-cycle costs		
		Surface type	km	US\$ /km	US\$m	years	US\$m /year	US\$/k m/year	US\$m	US\$/k m	years	US\$m /year	US\$m /year	US\$m /year
Trunk Roads	12 690		3 493		137.6		13.3				61.8	75.0	212.7	6.1%
Asphalt	1 600	500 000	802	30	26.7	1 150	1.8	110 000	12	14.7	16.5	43.3	5.4%	
Bituminous	4 730	300 000	1 420	30	47.3	1 040	4.9	23 000	9	12.1	17.0	64.4	4.5%	
Gravel	6 360	200 000	1 271	20	63.6	1 020	6.5	22 000	4	35.0	41.5	105.0	8.3%	
Urban Roads	4 060		796		31.3		7.3				15.2	22.5	53.8	6.8%
Asphalt	410	404 400	167	30	5.6	1 900	0.8	83 550	12	2.9	3.7	9.2	5.5%	
Bituminous	1 520	227 300	346	30	11.5	1 900	2.9	27 580	9	4.7	7.6	19.1	5.5%	
Gravel	2 130	133 000	283	20	14.2	1 700	3.6	14 400	4	7.7	11.3	25.5	9.0%	
Feeder Roads	32 610		873		43.5		13.0				38.8	51.8	95.4	10.9%
Bituminous	1 210	141 300	172	30	5.7	470	0.6	16 200	9	2.2	2.8	8.5	4.9%	
Gravel	17 770	30 000	533	20	26.6	470	8.4	6 300	4	28.1	36.4	63.1	11.8%	
Earth	13 630	12 300	168	15	11.2	300	4.1	1 250	2	8.5	12.6	23.8	14.2%	
Total	49 370		5 162		212.5		33.6				115.8	149.4	361.8	7.0%
Overheads					10.6		1.7			5.8	7.5	18.1		
Grand total			5 162		223.1		35.3				121.6	156.8	379.9	7.4%

1.1.2 Extended Scenario

The extended scenario considers the financial requirements network in its current condition. By classifying the national road network under “good”, “fair” and “poor” conditions, the extended scenario estimates both the cost of bringing the entire network to good condition and the recurrent costs of maintenance and asset replacement. The assumption here is that, as a first step, if a country’s network is in a poor condition, it would require funds to bring it to a good condition and then maintain it as the need arises.

Consideration of this scenario is particularly important where a government must finance from its own resources of the cost of construction, maintenance and also future asset replacement. In estimating the additional cost of network rehabilitation, the entire road network is reclassified based on road class, surface type and surface condition as shown in *Table 2*. For each surface type in poor or fair condition, the appropriate maintenance intervention is recommended. Each intervention has an associated unit cost and a time interval for repeating that activity.

Table 2 Cost of clearing existing backlog

Road class / Surface type	Network condition	Required intervention	Network length	Cost of clearing backlog		Over 10 years
				US\$/km	US\$m	US\$m/year
			km			
Trunk roads			8 911		1 271	127.1
Asphalt			412		86	8.6
	<i>Poor</i>	<i>Reconstruct</i>	104	500 000	52	5.2
	<i>Fair</i>	<i>Overlay</i>	308	110 000	34	3.4
Bituminous			2 650		336	33.6
	<i>Poor</i>	<i>Reconstruct</i>	994	300 000	298	29.8
	<i>Fair</i>	<i>Reseal</i>	1 657	23 000	38	3.8
Gravel			5 848		848	84.8
	<i>Poor</i>	<i>Reconstruct</i>	4 043	200 000	809	80.9
	<i>Fair</i>	<i>Regravel</i>	1 805	22 000	40	4.0
Urban roads			2 889		396	39.6
Asphalt			240		62	6.2
	<i>Poor</i>	<i>Reconstruct</i>	132	404 400	53	5.3
	<i>Fair</i>	<i>Overlay</i>	107	83 600	9	0.9
Bituminous			883		122	12.2
	<i>Poor</i>	<i>Reconstruct</i>	487	227 400	111	11.1
	<i>Fair</i>	<i>Reseal</i>	396	27 600	11	1.1
Gravel			1 767		212	21.2
	<i>Poor</i>	<i>Reconstruct</i>	1 575	133 000	210	20.9
	<i>Fair</i>	<i>Regravel</i>	192	14 400	3	0.3
Feeder roads			26 267		448	44.8
Bituminous			522		45	4.5
	<i>Poor</i>	<i>Reconstruct</i>	291	141 300	41	4.1
	<i>Fair</i>	<i>Reseal</i>	231	45 300	4	0.4
Gravel			14 568		311	31.1
	<i>Poor</i>	<i>Reconstruct</i>	9 239	30 000	277	27.7
	<i>Fair</i>	<i>Regravel</i>	5 330	6 300	34	3.4
Earth			11 177		93	9.3
	<i>Poor</i>	<i>Reconstruct</i>	7 088	12 300	87	8.7
	<i>Fair</i>	<i>Reshape</i>	4 089	1 300	5	0.5
Total			38 068		2 115	211.5
Overheads (5%)					110	11.0
Grand total					2 221	222.1

Approximately US\$2.2 billion is needed to clear existing maintenance backlog in order to bring the entire network to good condition. A national road development objective could, for example, involve a programme that aims at clearing all road maintenance and reconstruction backlogs within a defined time frame. In this case study, a 10-year network rehabilitation programme is assumed. This implies that the initial cost of network rehabilitation could be financed within a 10-year period at an annual cost of US\$222 million, excluding interest on invested capital.

Additional funds will also be needed for routine and periodic maintenance and also asset replacement at the end of the network life. From the base scenario, annual maintenance and asset replacement costs are US\$156.8 million and US\$223 million respectively. The annual life cycle cost of the national road network therefore amounts to US\$602 million. This is what is required, at least for the next 10years, to pay for current network improvement and maintenance and future network replacement costs. The summary of the expected network financing plan is shown in *Table 3* below.

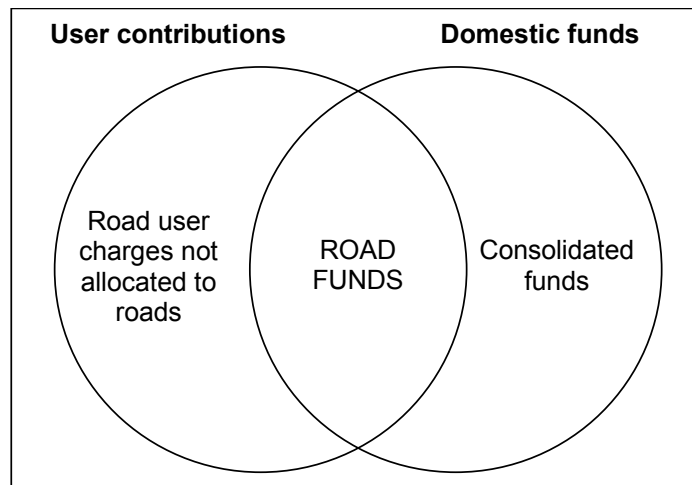
Table 3 Annual network life cycle costs in Ghana (extended scenario)

Road class/ surface type	Cost of clearing backlog		Annual maintenance costs	Annual asset replacement costs	Annual life cycle costs
	US\$m	US\$m/year*	US\$m/year	US\$m/year	US\$m/year
Trunk roads	1 271	127.1	75.0	137.6	339.7
Asphalt	86	8.6	16.5	26.7	51.8
Bituminous	336	33.6	17.0	47.3	97.9
Gravel	848	84.8	41.5	63.6	189.9
Urban roads	396	39.6	22.5	31.3	93.4
Asphalt	62	6.2	3.7	5.6	11.8
Bituminous	122	12.2	7.6	11.5	31.3
Gravel	212	21.2	11.3	14.2	46.7
Feeder roads	448	44.8	51.8	43.6	140.2
Bituminous	45	4.5	2.8	5.7	13
Gravel	311	31.1	36.4	26.6	94.1
Earth	93	9.3	12.8	11.2	33.3
Total	2 115	211.5	149.4	212.5	573.4
Overheads	106	10.6	7.5	10.6	28.7
Grand total	2 221	222.1	156.8	223.1	602.0

Notes: *Cost of clearing backlog is spread over 10years. Interest rate used is 0%.

2.2. Financing

On the revenue side, the model distinguishes between what road users are paying into the system and what amount is actually allocated to the road sector. User contributions look at all revenues generated directly or indirectly from road users without regards to where or how these funds are allocated. Domestic funds consider all funds from domestic sources that are allocated exclusively for road financing. They include allocated user revenues and other general budgetary allocations to the road sector. Since the goal is to measure the extent to which road users are “paying their way”, the model ignore contributions from donor assistance.



For countries like Ghana with a road fund system, the domestic funds will usually be the sum of road user charges and the road sector share of consolidated fund (or allocation from general budget).

1.1.3 *User contributions and domestic funds*

The major sources of road user contributions in Ghana are the (1) fuel levy (2) vehicle registration fees (3) vehicle inspection fees (4) international transit fees and (5) road/bridge/ferry tolls. The objective of the government is to ensure that allocated user charges cover at least annual maintenance costs [1]. This objective has been constrained by the low political support for review of user charges. These user charges are legislated and always require parliamentary approval for review, but this political consensus is often difficult to reach. The setting of user charges actually takes into account the damaging effect of the vehicle types on the road network. They are base on axle loading and vehicle configuration, with heavier vehicles paying relatively higher fees. Apart from fuel revenue, all other revenues from road user charges are channelled directly into the road fund.

In the case of revenues from fuel related charges, which is currently the most important source of road funds, it is important to examine the difference between what users contribute and what is actually channelled to the road fund (see *Table 3*).

User contributions from fuel levies are the amount of fuel tax in excess of normal sales taxes. The analogy here is that, if fuel should be sold under normal market conditions just like “mineral water”, that is with no specific additional fuel related taxes added, then any tax payments in excess of normal sales taxes could be considered as road users “extra” contribution to the economy. The essence of this distinction is that, by just looking at the road fund fuel levy to assess the extent to which users are “paying their way” we will be underestimating road users’ actual contribution to road funding in the country. In other words, road users are paying more for using the road network than what the legislated road fund fuel levy is telling us. *Table 4* illustrates the fuel pricing mechanised in Ghana and the estimation of user contribution [2].

Table 4 User contributions from fuel levies [2]

	Cost items	Unit	Diesel	Super gasoline	Comments
(0)	Crude Oil Price (barrel) f.o.b.	USD / barrel	77	75	Price on 09/2006
(1)	Crude Oil Price (liter) f.o.b.	USD / liter	0.48	0.40	
(2)	Refinery and distribution costs; Industry and dealer margins	USD / liter	0.19	0.18	Ghana National Petroleum Authority, 2005
(3)	Sales tax or VAT	USD / liter	0.10	0.08	VAT 15%
(4) = (1)+(2)+(3)	"Normal Sales Price" of unsubsidised fuel	USD / liter	0.77	0.66	
(5)	Ex-pump price	USD / liter	0.89	0.83	
(6) = (5)-(4)	"User contribution"	USD / liter	0.12	0.17	used to calculate user contribution
(7)	Road fund levy	USD / liter	0.07	0.07	GRF, 2006

From *Table 3*, the total user contributions from fuel are US\$ 17 cents for gasoline and US\$ 12 cents for diesel, which is equivalent to the ex-pump price less ex-refinery price and "normal" taxes and margins. Road fund fuel levy is US\$7 cents per litre. This means that only about one-half of what Ghanaian road users contribute, in terms of extra fuel taxes, actually goes to fund roads.

Table 5 shows the calculation of annual road user contributions from vehicle population and existing road user charges [3].

Table 5 Annual total road user contributions for Ghana

Vehicle population		Vehicle registration revenue			Vehicle inspection revenues			User contributions through fuel levies			International transit revenues			Toll revenues			Road fund
Vehicle type	No. of vehicles	Reg. veh.	Fee	Rev.	Vehicles inspected	Fee	Rev.	Fuel levy	Consumption	Rev.	No. int. transits	Fee	Rev.	No. of trips	Toll rate	Rev	Total
	[2005]		US\$	US\$m		US\$	US\$m	US\$/litre	Metric Tonnes	US\$m		US\$	US\$m		US\$	US\$m	US\$m
Motor Cycles	112 400	15 150	5.6	0.08	89 900	2.2	0.20	0.17	633 400	148.8				3 237 400	0.02	0.07	151.7
Cars	427 300	29 600	22.0	0.65	341 800	2.2	0.75				179 500	2.2	0.39	12 308 700	0.05	0.68	
Pickup /Light	48 800	8 700	33.0	0.29	39 000	3.3	0.13	0.12	928 500	134.4	76 900	2.4	0.19	1 405 300	0.09	0.12	137.8
Heavy Bus	107 400	5 600	43.9	0.25	85 900	3.8	0.33				59 700	4.4	0.26	3 094 500	0.14	0.44	
Light Trucks	37 500	2 500	55.6	0.14	30 000	3.3	0.10				20 500	2.6	0.05	1 079 200	0.20	0.21	
Medium Trucks	16 600	960	72.2	0.07	13 300	4.4	0.06				9 200	4.4	0.04	479 300	0.20	0.09	
Heavy Trucks	13 700	1 380	131.8	0.18	11 000	11.0	0.12				7 200	5.5	0.04	395 600	0.44	0.17	
Total	763 700	63 870		1.66	610 900		1.69			283.3	353 000		0.98	22 000 000		1.80	289.4

Notes Assumptions (1) cars, motorcycles consume premium and pick-ups, buses and trucks consume diesel. (2) Approximately all refined premium and diesel oils are consumed by vehicles. Exchange rate US\$ 1= GHC 9000

Total user contribution is about US\$290 million but domestic fund allocated to roads is only US\$185 million. In assessing the extent to which users are contributing to road financing, policymakers must be aware of the fact that over 45% of what users are actual paying are not allocated to roads.

Table 6 User contributions and total domestic funds for Ghana

Sources	Domestic funds	User contribution
Fuel	129.60	283.30
Vehicle registration	1.66	1.66
Vehicle inspection	1.69	1.69
International transits	0.98	0.98
Tolls	1.80	1.80
Consolidated funds	49.40	
Total	185.13	289.43

3. PERFORMANCE INDICATORS

How do we measure the extent to which sector objectives have been realised? How do we measure the performance of the road administration? To ensure that results of the model are useful to policymakers and the road administration, performance indicators that are measurable, comprehensive and holistic are developed. The indicators are tools for measuring the road sector performance in terms of revenue generation and allocation and the extent to which these funds cover road costs. To be objective and relevant, performance indicators ought to be broad enough to capture the essential concerns of the government and road administration [5]. They should also be flexible enough for use across different country contexts, and specific enough to be measured.

To summarise, the performance indicators should assist the road administration to

- evaluate the degree to which sector programmes have achieved their intended objectives,
- assess the efficiency of the road administration in implementing sector financing policies,
- develop alternative means of achieving financial objectives. For example by considering alternative sources of user revenues or cost minimisation strategies, and
- benchmarking and providing opportunity for sharing experiences.

3.1. Key performance indicators

These indicators measure the extent to which existing user contributions and allocated domestic funds cover estimated life cycle costs of the road network.

Table 7 Key performance indicators for Ghana and Namibia

Performance indicator	Ghana	Namibia
User contributions in relation to		
(a) routine maintenance costs	862%	604%
(b) total maintenance costs	194%	93%
(c) total costs (base scenario)	76%	43%
(d) total costs (extended scenario)	48%	32%
Domestic funds as in relation to		
(a) routine maintenance costs	551%	786%
(b) total maintenance costs	124%	122%
(c) total costs (base scenario)	49%	56%
(c) total costs (extended scenario)	31%	42%
Domestic funds as share of user	54%	130%

User contribution

In Ghana, existing user contributions are able to cover all expected maintenance costs but can fund only up to 76% of the estimated total costs. This implies that if government decides to allocate all revenues from road user charges to the road sector, these user contributions are sufficient to finance up to 76% of expected road costs. User contribution as share of road costs is 43% in Namibia. Moreover, if the cost of initial network rehabilitation is included, then user contributions can cover only up to 48% of the total life cycle costs compared with only 32% for Namibia.

Domestic funding

On domestic funds as share of user contributions, that only 54% of what road users in Ghana contribute is eventually allocated for road financing compared to 130% in Namibia. This means that 46% of what road users in Ghana are contributing actually goes to subsidize other sectors of the Ghanaian economy, and in Namibia the road sector is receiving subsidy. Again, existing allocated domestic funds are sufficient to fund road maintenance in both countries, but are only able to finance 49% and 56% of the total costs in Ghana and Namibia respectively. If the costs of clearing current maintenance backlogs are included, domestic funds are only able to cover 30% total road costs in Ghana and 42% in Namibia.

3.2. Secondary performance indicators

The secondary indicators measure indirect impacts of road sector under funding and also assist in explaining the differences in the key indicators figures.

Table 8 Secondary performance indicators for Ghana and Namibia

Performance indicator	Ghana	Namibia	Unit
Road density	0.21	0.05	km/km ²
User contributions per vehicle	379	801	US\$/year
User contributions as share of GDP	3.3	2.7	%
User contributions per capita	13.8	72.9	US\$/year
Domestic funds as share of GDP	2.1	3.5	%
Road maintenance costs in relation to total road costs	39.3	46.4	%
Road maintenance costs as share of GDP	1.7	2.9	%
Total road costs as share of GDP	4.3	6.2	%
Affordable network (with domestic funds)	35.7	56.4	%
Affordable network (with user contributions)	76.2	43.3	%

User contributions

Though both countries derive total amount from user contributions, user contributions per vehicle is about twice that pertains in Ghana. But Ghana's low user charges appear to be compensated by its relatively high motorisation. With roughly the same network size, motorisation in Ghana is over 700,000 vehicles compared with less than 200,000 vehicle population in Namibia. Higher motorisation offers benefits of economy of scale. If a government policy requires that road costs be solely financed from user charges, then with the same network size and comparable costs, countries with higher levels of motorisation can expect to have relatively lower user charges. To what extent should users contribute to financing an oversized network? Will it be economically justifiable for road user to pay for roads, which have been oversupplied?

Road maintenance costs

Road maintenance is an important component of a road-financing plan. The cost-revenue model indicates that to ensure that maintenance is not under funded, road maintenance funds should be about 39% (Ghana) and 46% (Namibia) of total road budget. In other words, for maintenance to be fully carried out in Ghana on an annually basis, government must allocate 1.7% of annual GDP for road maintenance. The total road cost as share of GDP is 4.3%. This figure will be higher if the costs of clearing existing maintenance backlogs are included. Currently government annual allocation from domestic sources to the road sector stands at 2.1% of GDP – which is less than 50% of what is required.

Affordable network

Now, supposing domestic funds are the only source of financing the road sector, then based on existing level of domestic funding, only 36% of Ghana's road network is maintainable, which is low when compared with Namibia's 56% maintainable road network. On the other hand, if user contributions are the sole source of sector financing and if all will be allocated to the road sector, then 76% of Ghana's road network and 43% that of Namibia are maintainable with current user contributions.

Another indicator, which measures the burden of road costs on a country, is road density. As can be expected, countries with higher road densities (measured in km/km²) will spend more on roads than those with lower road densities. Ghana's road density is about four-folds that of Namibia. Higher road density means greater accessibility, but it also implies higher required road investment and maintenance costs. It is therefore important for a country to strike an appropriate balance between the need to increase accessibility - by building more roads – and reducing life cycle costs by keeping to an affordable (or a maintainable) network size.

4. CONCLUSION

Roads are indispensable catalysts for the socio-economic development of any country since they provide citizens with required access to social services and economic opportunities. Despite these important functions of road, the road sector in many developing countries still remains grossly under funded. This has resulted in a large share of road networks in poor conditions. Under funding or deferred needed maintenance have severe future cost implications. Failing to provide maintenance at the appropriate time leads to more costly future network maintenance and reconstruction. These additional costs are estimated to be 25% (Namibia) and 37% (Ghana) of network life cycle costs.

Although user contributions form a significant source of road budgets, they are not sufficient to cover the estimated life cycle costs of the road network. Again only one-half of what road users contribute, in the form of road user related charges, are actually allocated to road financing with the rest going to cross subsidize other sectors of the economy. These disparities between user contributions and allocated domestic funds underestimate the extent to which road users are contributing to the road sector or the national economy. Efficient allocation of existing road revenues should therefore be the first step to addressing the problem of sector under funding.

With current levels of maintenance backlog, about 4.5% of GDP would be required to finance the life cycle cost of the network. The required cost of maintenance is 1.5-2.0% of GDP. How can developing countries ensure adequate funding for the road sector? The obvious solution is to increase existing user charges. But how much of road costs are road users able or willing to bear? It is recommended that where a government is unable to increase user charges to bridge financing gaps, due to say political or economic reasons, the road network could be reduced to an affordable size. It is justifiable to have a network size which existing resources can adequately fund rather than an oversized network, which is left to deteriorate due to lack of adequate funding.

REFERENCES

- [1] GHA (Ghana Highway Authority), (2005). *Cost per Kilometre of Key Road Works*. Unit Cost Estimates from the Ghana Highway Authority, Accra-Ghana.
- [2] IMF (International Monetary Fund). (January 2004). Ghana Petroleum Pricing Formula
- [3] MRT (Ministry of Roads and Transport). RSDP Review Reports 2001-4, Ghana.
- [4] NRFA (National Road Fund Administration). (2004). *Five-Year Business Plan April 2004 to March 2009*. Third Draft., Windhoek, Namibia.
- [5] Talvitie, A., (1998). Performance Indicators for the Road Sector. World Bank, 1818 H Street, N.W. Washington D.C. 20433, U.S.A.