

CHAPTER 4 REVIEW AND ANALYSIS OF FACTORS AFFECTING ROAD MAINTENANCE

4.1 General

For the purposes of good, consistent management, the most useful way to classify maintenance activities is in terms of their frequency, which can be defined as follows:

- **Routine** maintenance: works that may need to be undertaken each year either continually through the year or at intervals during the year
- **Periodic** maintenance: works that are planned to be undertaken at intervals of several years
- **Emergency** maintenance: works whose frequency cannot be determined but require immediate action

Table 4.1.1 shows some typical examples of each type of maintenance work.

Table 4.1.1 Typical Maintenance Activities by Maintenance Type

Type of Maintenance	Activity
Routine	Bush clearing
	Drain cleaning
	Road sign maintenance
	Pothole patching
	Grading
	Crack sealing
Periodic	Re-gravelling
	Resealing
	Road markings
	Overlays
Emergency	Removal of debris or obstacles

A number of physical factors affect the frequency and nature of road maintenance works. The key factors are:

- Road Surface Type
- Traffic Flows and Composition
- Road Surface Condition
- Climate
- Terrain

Combinations of the above factors can have a significant impact on road maintenance expenditure, e.g. earth roads in wet climate zones or any road surface type with a high heavy

goods vehicle content. The design and the quality of construction of the original pavement will also play a major part in likely future maintenance works. Each of these factors is discussed in the following sections.

4.2 Road Surface Type

Table 4.2.1 shows the lengths of classified and unclassified roads for each road surface type:

Table 4.2.1 Road Length by Surface Type for Classified and Unclassified Roads

Province	Road Class	Premix	Surface Dressed	Gravel	Earth	Total (km)
All Provinces	Classified (km)	1,508.4	7,163.3	27,901.7	27,368.5	63,941.9
	(%)	2.4	11.2	43.6	42.8	100.0
All Provinces	Unclassified (km)	2,128.8		6,465.1	125,441.4	134,035.3
	(%)	1.6		4.8	93.6	100.0
Total	All Roads (km)	3,637.2	7,163.3	34,366.8	152,809.9	197,977.2
	(%)	1.8	3.6	17.4	77.2	100.0

Source: Schedule of Classified Roads in 1996; Annual Management Maintenance Needs of Local Authorities, May 1998; 1994 Local Authorities Road Inventory Survey

*Note: According to the Ministry of Roads and Public Works, the length of the unclassified road network is 94,161.1km, resulting in a total road network of only 158,103.0km.

As can be seen from the table, over 86% of the classified road network was unpaved in 1996 and over 98% of the unclassified road network was unpaved in 1994 (Local Authorities Road Inventory Project). This means that 95% of the entire road network in Kenya is unpaved.

Table 4.2.2 Road Condition by Surface Type for Classified Roads

Item	Paved Roads (km)				Unpaved Roads				Total Km
	Good	Fair	Critical	Failed	Good	Fair	Poor	Bad	
All Provinces	2,588.3	3,257.4	1,505.4	1,452.6	631.0	30,640.7	18,120.0	5,467.9	63,663.3
%	29.4	37.0	17.1	16.5	1.2	56.9	33.0	10.0	

Source: Strategic Plan for the Roads Sector, March 1997.

Note that the total km in Table 4.2.2 is 278.6km lower than that in Table 4.2.1. This is due to some corrections made to the data during the preparation of the 1997 report.

For the classified road network (Table 4.2.2), 66.4% of the paved roads were in a Good or Fair condition and 57.1% of the unpaved roads were in Good or Satisfactory/Fair condition in 1997. Note that 33.6% of the paved network was either in a critical condition or had already failed.

Table 4.2.3 Road Condition by Surface Type for Unclassified Roads

Province		Paved				Unpaved			Total (km)
		Good	Fair	Poor	Bad	Good	Fair/Poor	Bad	
All Provinces	km	65.6	1,106.3	951.0	5.9	6,211.8	54,596.4	69,090.2	132,027.2
	%	3.1	52.0	44.6	0.3	4.8	42.0	53.2	

Source: Annual Management Maintenance Needs of Local Authorities, May 1998; 1994 Local Authorities Road Inventory Survey

Note that the total km in Table 4.2.3 is 2008.1km less than that in Table 5.2.1. There is no explanation of the differences in the report.

For the unclassified roads (Table 4.2.3), 55.1% of the paved roads were in Good or Fair condition and 46.8% of the unpaved roads were in Good or Fair/Poor condition from the 1994 survey.

Table 4.2.4 Roads in Maintainable and Non-Maintainable Condition

Province	Road Class	Maintainable			Non-Maintainable		
		Paved	Unpaved	Total	Paved	Unpaved	Total
All Provinces	Classified (km)	7,351.1	49,391.7	56,742.8	1,452.6	5,467.9	6,920.5
	%	11.5	77.6	89.1	2.3	8.6	10.9
All Provinces	Unclassified (km)	2,122.9	60,808.2	62,931.1	5.9	69,090.2	69,096.1
	%	1.6	46.1	47.7	0.0	52.3	52.3
Total	All Roads (km)	9,474.0	110,199.9	119,673.9	1,458.5	74,558.1	76,016.6
	%	4.8	56.3	61.1	0.7	38.1	38.8

Table 4.2.4 shows the lengths and percentages of roads in maintainable and non-maintainable condition. For defining maintainable and non-maintainable, we have assumed that roads in a Bad or Failed condition are non-maintainable and need rehabilitation. For the classified roads 56,742.8km (89.1%), and for the unclassified network 62,931.1km (47.7%) are in a maintainable condition. On the basis of these assumptions, 119,673.9km (61.1%) of the entire network is in a maintainable condition. It must be remembered that this data is up to 7 years old and so the figures may be considerably different today. The road condition data requires to be updated urgently to enable sensible decisions on maintenance works to be made. Note that unpaved roads also need a program of regular and systematic attention.

4.3 Traffic Flows and Composition

Table 4.3.1 shows the median number of vehicles by road class for 1997. This data is based on traffic census data for 1,852 survey stations. Unfortunately, we are not able to convert this to national travel volumes, as there are no conversion factors and no reliable vehicle-kilometer parameters available for Kenya.

Table 4.3.1 The Median Number of Vehicles by Road Class for 1997

Road Class	Number of Survey Stations	Number of Vehicles (7am – 7pm) (Median)
A	254	1,721
B	208	1,205
C	630	290
D	423	68
E	337	33

Note: Kenyan Traffic Census Data for 1997.

It is recognized that Heavy Goods Vehicles (HGVs) cause the most damage to road pavement, so it is important to look at the HGVs on the roads in Kenya. Table 5.3.2 shows the traffic mix for each road class. It can be seen that for Class A Roads the HGV percentage is 17.6%. For the other classes of road the percentages are 8.1% for Class B, 4.3% for Class C, 2.3% for Class D and 2.5% for Class E. The HGV percentage is very important, particularly for the design of the original pavement, as well as for determining a suitable maintenance profile for the road. HGVs will greatly influence the life of the pavement and the likely need for interventions, including patching, overlays and reconstruction. For unpaved roads, it will affect the frequency of grading and re-gravelling.

Table 4.3.2 % Vehicle Composition for Each Road Class

Road Class	Car	Light Goods	Matatu	Medium Goods	Medium Tanker	Heavy Goods	Heavy Tanker	Buses	HGV %	Total
A	28.7%	21.7%	22.2%	1.1%	8.6%	2.1%	11.4%	4.1%	17.6%	100.0%
B	29.3%	26.8%	27.0%	0.6%	8.1%	0.7%	3.7%	3.7%	8.1%	100.0%
C	30.3%	28.2%	28.8%	0.7%	7.6%	0.3%	1.9%	2.1%	4.3%	100.0%
D	24.7%	37.6%	25.8%	0.8%	8.9%	0.3%	0.8%	1.2%	2.3%	100.0%
E	23.0%	42.0%	22.9%	0.7%	8.9%	0.1%	1.5%	0.9%	2.5%	100.0%

Source: Analysis based on data from the Kenyan Traffic Statistics for 1997.

Note: A Matatu is a vehicle licensed to carry fare-paying passengers and is usually a minibus or small coach.

4.4 Road Surface Condition

The road surface condition at the start of any maintenance evaluation period will affect the maintenance works to be done during that period. For a new road, off-road maintenance will remain the same but the surface works should be minimal. For a pavement 5 to 10 years old, the surface works will involve crack sealing, pothole patching, repairs to rutting and so on. There are a number of ways to establish the road condition, with some involving expensive high technology equipment not appropriate for Kenya at this stage of the development of its road sector. The following methods that may be suitable for Kenya at this time are as follows:

- Bump integrator method
- Drive-through method to measure road roughness
- Present Serviceability Rating (PSR) method
- Present serviceability index (PSI) method
- Roads 2000 road condition survey method

4.5 Climate

There are basically four climate zones in Kenya and they are as follows:

- Moist Sub-Humid
- Dry Sub-Humid
- Semi Arid
- Arid

Over many years of investigation throughout the world, it has been shown that water is the most common cause of pavement failure. This can be due to water penetrating the pavement through surface cracking, water in the pavement layers due to inadequate drainage, wash out and erosion of slopes due to inadequate drainage, etc. In these areas, it is essential that pavement and drainage design take account of the climate condition, and the maintenance regime should also pay particular attention to the sealing of cracks, repairing potholes and attention to drainage problems before these defects develop into much more expensive repair items.

4.6 Terrain

Terrain can impact road maintenance. In hilly or mountainous areas, the drag effect on the road surface from a vehicle tire is much more significant particularly from HGVs. The effect is much more noticeable on earth and gravel roads but sometimes even on paved roads where perhaps a soft bitumen has been used, rippling effects on the road surface can be observed. The drainage in hilly and mountainous areas also needs special care. Water travels at higher speeds and so the scour and erosion effects will be more noticeable. Varying geological conditions can also have an impact on maintenance works particularly in areas with difficult ground conditions, such as Black Cotton Clay, which can cause serious problems for roads. Proper account of such materials should be taken during the design of the roads pavement.

CHAPTER 5 DEFINING THE NEEDS OF THE ROAD MAINTENANCE SYSTEM

5.1 General

The purpose of this chapter is to define the (funding) needs of Kenya’s road network, as well as the types of scenarios that may be necessary to satisfy those needs. This is carried out via the methodology described in Section 5.2 below. Based on this methodology, a model is constructed and applied to assess the future costs and benefits that arises from maintaining Kenya’s road network at different levels of service, and various future funding and cost-reduction scenarios are examined with an eye towards the realization of these service levels.

5.2 Methodology for Analyzing Funding Needs & Scenario Implementation

The methodology applied to determine the funding needs of Kenya’s road network and the possible scenarios to meet those needs is as shown in Figure 5.2.1 below.

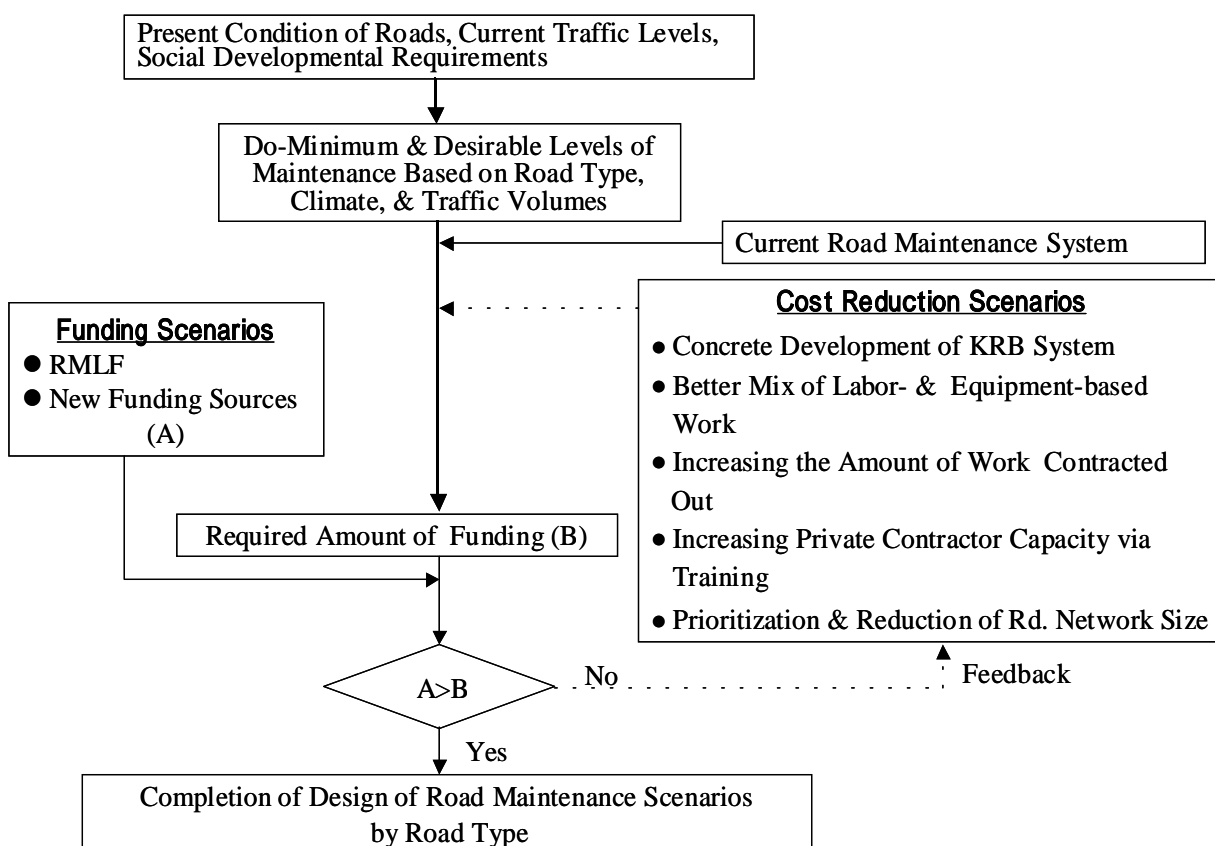


Figure 5.2.1 Workflow for Needs Gap Analysis

5.3 Calculation of Funding Needs

A model was constructed to estimate road maintenance costs/benefits for Kenya as a whole. The purpose of the model is to grasp the budgetary needs and restraints on Kenya’s road network. Including the key factors in Section 3.1 of this document, a model to estimate the costs/benefits of road maintenance for a “Do-Minimum” and “Desirable” Case for a 15-year lifecycle was built for representative sections of the road network with the following inputs:

- Road class
- Road surface type
- Road surface condition
- Climate
- Terrain
- Traffic flow and composition
- Social Costs (vehicle operating costs)
- Maintenance frequency and unit costs

Applying the above-mentioned inputs, the costs/benefits of maintenance were calculated for Kenya’s road network for 2001 to 2015 using the HDM-4 model. Table 5.3.1 to 5.3.3 indicate the undiscounted costs for road maintenance by road type, road agency, and surface type, respectively. As Table 5.3.1 shows, secondary & minor roads account for the majority of the maintenance costs required for either the “Do-Minimum” or “Desirable” Cases. This is due to its network being much more extensive than either the trunk or primary road network. In terms of percentages, the trunk, primary, and secondary & minor roads account for 23%, 18%, and 59% of the maintenance costs for the Do-Minimum Case and 22%, 15%, and 63% for the Desirable Case.

Table 5.3.1 Summary of Undiscounted Costs by Road Type for 2001-2015 (Ksh millions)

Road Type	Do-Minimum Maintenance			Desirable Maintenance		
	Periodic	Routine	Total	Periodic	Routine	Total
Trunk Roads	64,154	5,825	69,979	81,631	5,763	87,395
Primary Roads	20,632	34,003	54,635	25,072	34,195	59,267
Secondary & Minor Roads	96,423	86,119	182,542	161,902	92,669	254,571
Total	181,208	125,947	307,156	268,605	132,627	401,232

Road maintenance costs by surface type indicate that the total for unpaved roads is approximately 2.3 and 2.0 times that for paved roads, respectively, for the Do-Minimum and Desirable Cases (see Table 5.3.2). This is due to the unpaved road network being much more extensive (about 13.9 times that of the paved network). As for cost per kilometer, it is much

greater for paved than unpaved roads because of the materials/technical know-how involved.

Table 5.3.2 Summary of Undiscounted Costs by Surface Type for 2001-2015 (Ksh millions)

Road Surface Type	Do-Minimum Maintenance			Desirable Maintenance		
	Periodic	Routine	Total	Periodic	Routine	Total
Paved Roads	86,386	7,632	94,018	125,180	7,431	132,611
Unpaved Roads	94,822	118,315	213,137	143,425	125,196	268,622
Total	181,208	125,947	307,156	268,605	132,627	401,232

As for the maintenance costs of roads agencies (i.e., the Roads Department (RD) and District Roads Committees (DRCs)), Table 5.3.3 indicates that the total maintenance costs from 2001 to 2015 for the DRCs (which are in charge of secondary & minor roads) is about Ksh 182,542 million and Ksh 254,571 million for the Do-Minimum and Desirable Cases, respectively. For the RD, which is in charge of the trunk and primary roads, maintenance costs for the same period for the Do-Minimum and Desirable Cases is about Ksh 124,614 million and Ksh 146,662 million, respectively. Based on this, the percentage of the total amount of money required by the RD and the DRCs, purely from an expenditure viewpoint, would be 41% and 59%, respectively, for the Do-Minimum Case, and 37% and 63%, respectively, for the Desirable Case. Under the KRB, it has been decided at present that RD should get 57% and the DRCs 40% of the RMLF. These numbers, from a cost perspective only, might need to be re-considered.

As shown in Table 5.3.4, the Class A, B, and C roads of the RD produce much greater benefits than those of the DRCs. That is, despite the maintainable trunk and primary road network being much smaller than the secondary & minor road network (about 10 times smaller), the total net present value (NPV) of the former is approximately 3.8 times greater for the Do-Minimum maintenance case. From the perspective of economic returns, it can be said that investment in the maintenance the roads of the RD is a much better investment, which is due to the much greater traffic loads processed by the trunk and primary road network.

Table 5.3.3 Summary of Undiscounted Costs by Road Agency for 2001-2015 (Ksh millions)

	Do-Minimum Maintenance			Desirable Maintenance		
	Periodic	Routine	Total	Periodic	Routine	Total
Roads Dept. (Trunk & Primary Roads)	84,786	39,828	124,614	106,703	39,959	146,662
DRCs (Secondary & Minor Roads)	96,423	86,119	182,542	161,902	92,669	254,571
Total	181,208	125,947	307,156	268,605	132,627	401,232

Table 5.3.4 Summary of NPV by Road Agency for 2001-2015 (Ksh millions)

	Do-Minimum Maintenance	Desirable Maintenance
Trunk & Primary Roads	163,585	179,048
Secondary & Minor Roads	42,858	15,865
Total	206,443	194,914

5.4 Comparison of Funding Needs & Existing Available Funding

5.4.1 Funding Needs

As shown in Section 5.3.3, to bring all of Kenya’s roads up to the “Desirable” state of being in good condition for the maintenance lifecycle of 2001 to 2015, Ksh 401,232 million would be required, while to bring them up to the “Do-Minimum” state of being in fair condition would require Ksh 307,156 million. From a cost-effectiveness viewpoint, it is better to maintain trunk and primary roads in a “Desirable” state and secondary & minor roads in a “Do-Minimum” state of service, since this produces the highest net present value for the network as a whole. We can refer to this as the “Best Case”, and the cost of maintaining roads in Kenya at this service level would require Ksh 329,204 million. Below, funding for the 2001 to 2015 period is determined to see what maintenance Cases, if any, fund resources are capable of financing and the possibility of other potential funding sources to make up for any short-fall.

5.4.2 Existing Available Funding

Current Sources

The current sources of funding for road maintenance are as follows:

- Fuel levy
- Transit toll
- CESS
- Part of the LATF (Local Authority Transfer Fund)

Of the above-mentioned sources, the fuel levy and transit toll account for the vast majority of the funding for roads maintenance. Of the total of these two, the fuel levy accounts for approximately 96% and the transit toll for about 4%. At present, only the RMLF is available to the KRB for maintaining roads, and an amendment by Parliament to the KRB Act would be necessary to include any other existing or new revenue sources.

Revenue Forecast for Current Sources

As the above indicates, the most important source of existing available funding is the RMLF. To predict future RMLF revenues, the relationship between the growth in the RMLF and GDP is applied. As Figure 5.4.1 shows, there is a strong and reliable relationship between the RMLF and GDP, as indicated by the value of 0.80 for the coefficient of determination.

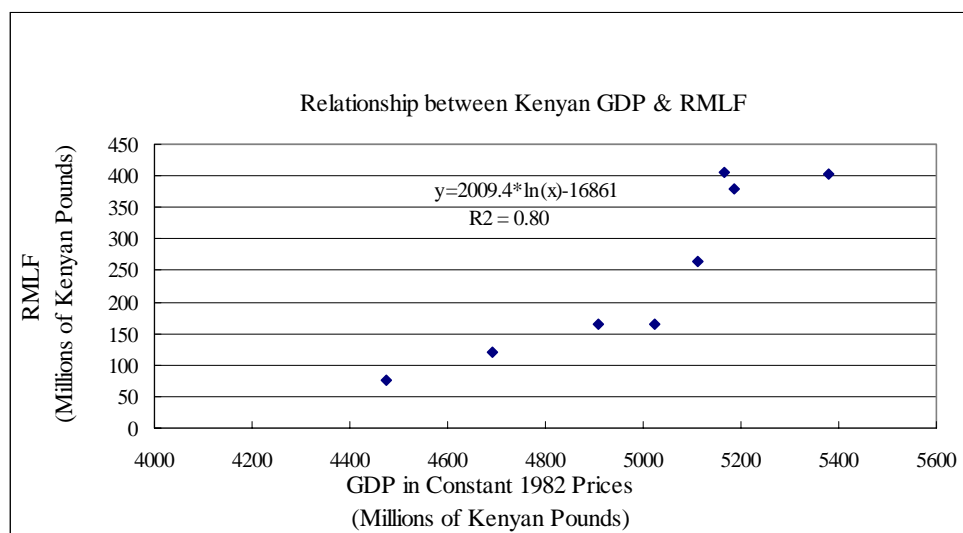


Figure 5.4.1 Relationship between Kenyan GDP & RMLF

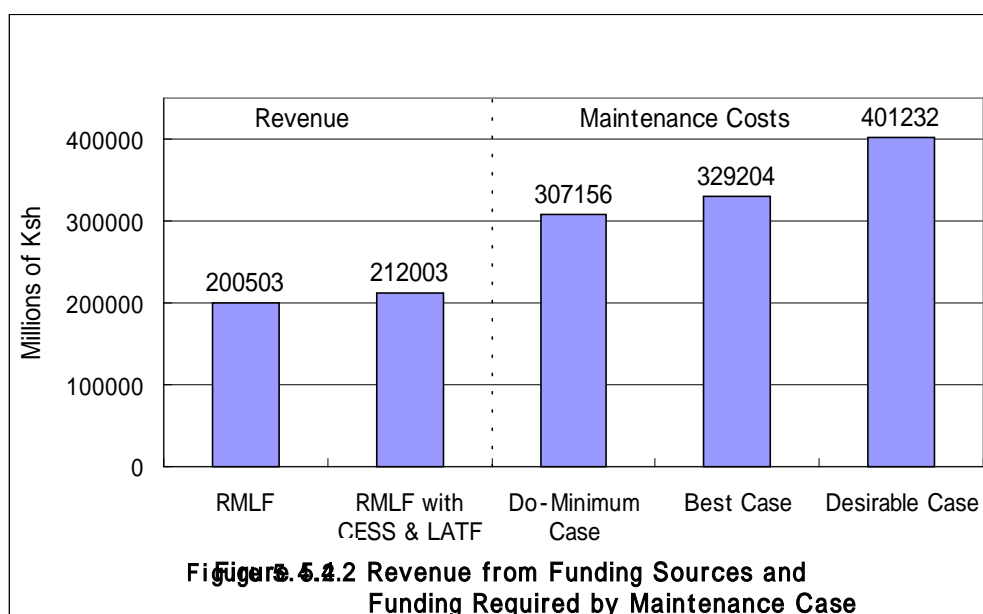
Using the above relationship, and the assumption that GDP will grow on average by 2.0% per year, future RMLF revenue was calculated (see Table 5.4.1). As for the fuel levy rate, since it is one of the highest among African countries with a roads board system, it was assumed that it would remain static. As the table indicates, average annual growth in revenue would be about 5.6%, resulting in the total money generated by the RMLF during 2001 to 2015 being Ksh 200,503 million. As for the CESS and LATF, revenue per annum for the CESS is assumed to be on average Ksh 400 million based on an analysis of existing trends, while the LATF (which is directly related to national revenue) is assumed to grow at the same rate as GDP, or 2%. Given this, the total revenue expected from the CESS is Ksh 6000 million and from the LATF Ksh 5500 million for a total of Ksh 11,500 million from 2001 to 2015.

Table 5.4.1 Forecast of RMLF Revenue (Ksh millions)

Fiscal Year	Revenue Collected by RMLF
2001	8,042
2002	8,841
2003	9,654
2004	10,451
2005	11,233
2006	11,999
2007	12,751
2008	13,489
2009	14,214
2010	14,926
2011	15,626
2012	16,314
2013	16,990
2014	17,655
2015	18,309
Total	200,503

5.4.3 Comparison of Funding Needs & Available Funding

Based on the above analysis and data, there is a shortfall in funding of Ksh 200,729 million and Ksh 106,653 million, respectively, for the maintenance needs of the Desirable and Do-Minimum Cases (see Figure 5.4.2). In the Best Case, which assumes trunk and primary roads are kept in good condition and secondary & minor roads in fair condition, the shortfall is Ksh 128,701 million. If we assume that the CESS and LATF are part of the pool of funds for road maintenance, then the shortfall for the Desirable Case, Best Case, and Do-Minimum Case would be Ksh 189,229 million, Ksh 117,201 million, and Ksh 95,153 million, respectively.



5.5 Potential Scenarios for Meeting Funding Needs Gap

As the above indicates, given the existing sources of road maintenance funding, there are insufficient monies to meet the road maintenance needs of Kenya. Below, potential scenarios are suggested to resolve this funding needs gap by looking at funding scenarios to increase revenue and cost-reduction scenarios to decrease expenditures. As for changes in the Kenyan tax structure itself, which could have an effect on either the revenues or costs for road maintenance, this was not considered since it would require major legislative action and is therefore almost impossible to forecast.

5.5.1 Funding Scenarios

Three potential sources that could be included in the KRB's pool of funds are: (1) the tolling of highly traveled roads, (2) the license revenue and fees from the traffic act, and (3) axle load excess fines. As for tolling, there are about four highly traveled routes that could possibly be tolled under a concession, which would be required in order to rehabilitate the roads to a standard high enough to charge money. However, due to the high returns that a concessionaire would need in this case, as well as to limitations on tolls due to other existing charges transport, revenues from this scheme would probably not be large.

As for revenue from licensing and fees under the traffic act, these were in 1998 a substantial Ksh 869.80 million, which is approximately 10% of the total for the RMLF, CESS, and LATF. It is argued here that since these activities contribute to road use indirectly these monies should be included as part of the funding for road maintenance. Annual average growth in revenue over the 2001 to 2015 period is assumed to be 4.4% based on recent data from the 1999 Kenyan Statistical Abstract, meaning that the total amount of revenue that could be expected from this source for this period is Ksh 19,577 million.

Finally, as for monies from axle load excess fines, these should go to maintaining roads, since overloaded vehicles have a significant impact on road conditions. Currently, about Ksh 1.4 million is collected monthly on overweight vehicles. However, due to rigorous enforcement of axle load regulations, there has been a steady decline in excess loads. Therefore, it is assumed that present average monthly revenue will remain static. Given this, total revenue to be collected from this funding source for 2001 to 2015 is estimated at Ksh 252 million.

Based on the above, the amount of money that could be via likely funding scenarios is Ksh 19,829 million. Add this to the existing funding described in Section 5.4 above and the total

revenue available for 2001 to 2015 is Ksh 231,832 million (see Figure 5.5.1). This indicates that money fund raising via existing or new sources alone will not solve the problem of financing roads. Therefore, cost-reduction measures must also be considered.

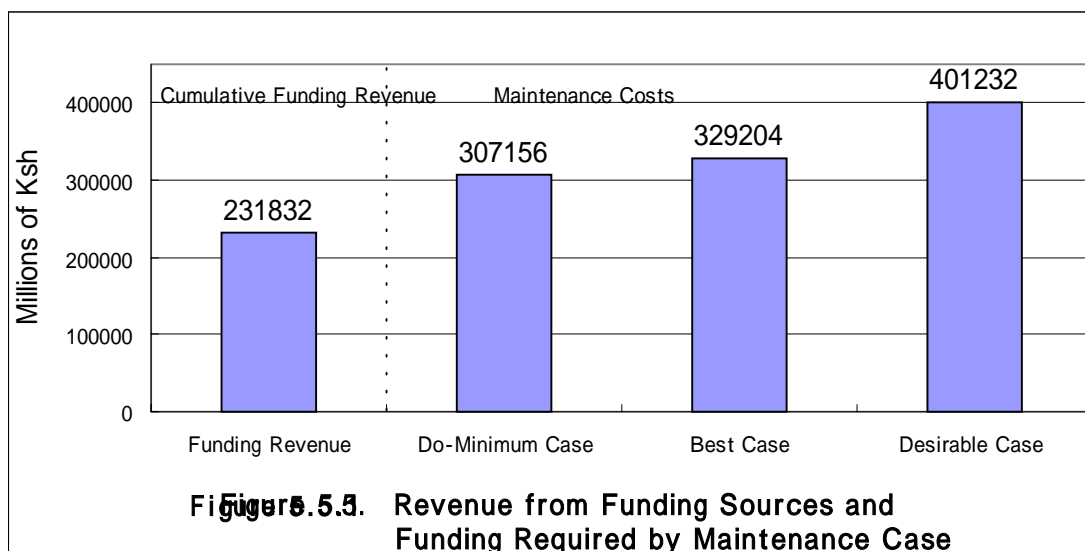


Figure 5.5.1. Revenue from Funding Sources and Funding Required by Maintenance Case

Note: Funding Revenue here is cumulative and includes, the RMLF, CESS, part of the LATF, fees from the Traffic Act, and fines from overweight heavy goods vehicles.

5.5.2 Cost-Reduction Scenarios

The cost-reduction scenarios that seem most likely are as follows:

- Reduction in costs due to better management resulting from the KRB system’s operation
- Reduction in costs due to better mix of labor- & equipment-based work
- Reduction in costs due to more work being contracted out to private contractors
- Prioritization & reduction of road network size

Reduction in Costs due to Better Management

This is difficult to quantify at this stage, but in countries such as Ghana there has been a significant improvement in management and in reducing costs as a result of implementing an effective roads board system such as the KRB. Here, it is assumed that better management is a facilitator for realizing the other three items mentioned at the beginning of this section.

Better Mix of Labor- & Equipment-based Work

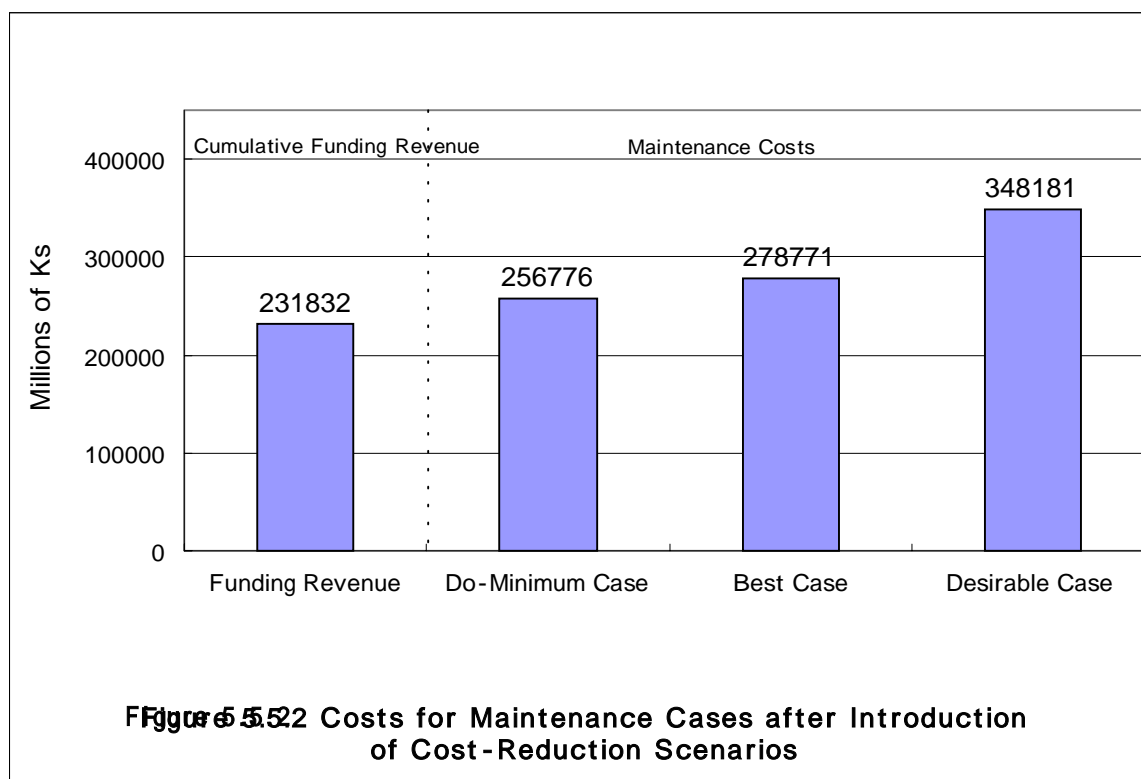
Studies by the International Labour Organization have shown that labor-based work can be 10% to 40% less expensive than equipment-based work. In Kenya, with initiatives such as the Roads 2000 program, together with the training program in Kisii (see Chapter 6), there has been some progress towards the effective utilization of labor-based work. On the other hand, such initiatives have still not taken hold throughout the entire road sector. Therefore, it is as-

sumed here that savings at a median of 20% is still possible in regards to routine maintenance. This would result in cost reductions of Ksh 25,189 million, Ksh 25,215 million, and Ksh 26,525 million for the Do-Minimum Case, Best Case, and Desirable Case, respectively. As for periodic maintenance, this is more equipment-based and no significant savings are possible.

Encouragement of Contracting out to Private Contractors

Contracting out fosters a more competitive environment that results in lower cost per unit. In Ghana’s, there was a decline in maintenance costs by 40% after the system changed from being force-account oriented to contracting out. Again, based on data for 15 other African countries from the World Bank’s RMI database on its website, the cost/km for maintenance work solely by force account was found to be 12% higher than work including private contractors.

At present, the vast majority of routine maintenance work is via force account, while most period maintenance is carried out with private contractors. Based on the above, it is assumed that a further savings of 20% for routine maintenance is possible. Given this and the previous savings from more effective use of labor-based work, the costs for implementing the Do-Minimum Case, Best Case, and Desirable Case would be Ksh 256,776 million, Ksh 278,771, and Ksh 348,181, respectively. This means that the costs for implementing these cases are still 1.11, 1.20, and 1.50 times greater than potential funding (see Figure 5.5.2).



Prioritization & Reduction of Road Network Size

As a final measure to match funding with costs, the road network can be prioritized into a core and non-core road network. The former would be funded and the latter would either have to be removed from the road network or funded with monies raised by local communities. The core network should have a significant effect on the national economy in moving people/goods around the country, roads involved with tourism that bring in foreign currency, and important agricultural access roads having an impact on local and export markets. Based on this, we can say that Kenya's Class A, B, and C roads, which function as international and national trunk roads and primary feeders, should be part of Kenya's core road network. The cost for maintaining Kenya's core road network (i.e., Class A, B, and C roads), without any cost-reduction measures, for the Do-Minimum Case and Desirable Case is Ksh 124,614 million and Ksh 146,662 million, respectively, for the 2001 to 2015 period. The Best Case, since it assumes that trunk and primary roads are to be kept in good condition, is the same as the Desirable Case. As can be seen here, there is enough money to fund the core road network even without cost-reduction measures or, for that matter, new sources of revenue.

Assuming that previous new sources of revenue and cost-reduction measures are implemented, there would be Ksh 123,149 and Ksh 101,154 million remaining after the maintenance costs for the 2001 to 2015 period for the Do-Minimum and Desirable Cases, respectively, for the non-core or secondary & minor road network. On the other hand, the money required to finance the secondary & minor road network for the Do-Minimum and Desirable Cases is Ksh 148,093 million and Ksh 217,502 million, respectively, assuming that cost-reduction measures are implemented. Since it is not cost-effective to maintain secondary & minor roads at the service level required by the Desirable Case, and cost effective to maintain the core road network at the Desirable Case level, the shortfall in funding for maintaining the secondary & minor road network is calculated to be equivalent to Ksh 46,939 million for the 2001 to 2015 period. There are three ways to make this difference up:

- Have local communities help pay for the costs of road maintenance
- Remove some of the roads from the road network
- A combination of the above two items

The shortfall of Ksh 46,939 million would be about Ksh 3,129 million per year, which is about 39% of the current total for the RMLF fund of Ksh 8,040 million. This is a rather large amount for local communities to bear themselves. Therefore, it seems inevitable that some portion of the secondary & minor road network will be retired from service. If local communities were unwilling or unable to bear this shortfall, approximately 29,000 km of road, or 23% of the secondary & minor road network, would be retired. Should this latter option be

chosen, then a method such as multi-criteria or cost-effective analysis should be applied.

5.5.3 Scenario Comparative Analysis

Scenario Comparison

Based on the above analysis, it can be said that there is sufficient funding for maintaining a core road network consisting of Class A, B, and C roads. This is true even if there are no new revenue sources or cost-reduction measures. On the other hand, even with new revenue sources and cost-reduction measures, there is not enough funding for the entire road network that would include secondary & minor roads. Although the funding gap can be reduced with the implementation of the funding and cost-reduction scenarios discussed above, there is no guarantee that all or even any of the above-mentioned funding and cost-reduction scenarios will be implemented. As shown in the table below, the amount of secondary & minor road that would have to be retired would vary from a high of about 80,000 km to a low of 29,000 km, or between 63% and 23% of the secondary & minor road network for the Best Case. Given this, the degree to which new funding sources and cost-reduction measures are successfully pursued is crucial.

Table 5.5.1 Comparison of Funding & Cost-Reduction Scenarios for the Best Case and the Amount of Road to be Retired

Funding and Cost-Reduction Scenarios	Funding Revenue (Ksh millions) (A)	Maintenance Costs (Ksh millions) (B)	A-B	Length of Secondary & Minor Rd to be Retired (km) *
Funding Scenario 1 (Base Case)	200,503	329,204	128,701	80,438 (63%)
Funding Scenario 2	212,003	329,204	117,201	73,251 (58%)
Funding Scenario 3	220,332	329,204	108,872	68,045 (54%)
Cost-Reduction Scenario 1	200,503	303,988	103,485	64,678 (51%)
Cost-Reduction Scenario 2	200,503	303,988	103,485	64,678 (51%)
All Funding Scenarios	231,832	329,204	97,372	60,858 (48%)
All Cost-Reduction Scenarios	200,503	278,771	78,268	48,918 (39%)
All Scenarios	231,832	278,771	46,939	29,337 (23%)

Funding Scenario 1: RMLF only.

Funding Scenario 2: RMLF, CESS, & LATF.

Funding Scenario 3: RMLF & New Funding Sources.

Cost-Reduction Scenario 1: Reduction in costs due to encouragement of labor-based work.

Cost-Reduction Scenario 2: Reduction in costs due to encouragement of contracting out.

*: Value in () is percentage of maintainable secondary & minor road network.

Recommendation

As the above analysis and discussion has shown, even with the achievement of all the funding and cost-reduction scenarios, there would still be a significant shortfall in funding to maintain the entire road network. Therefore, it is important that local authorities decide on what roads to retire and/or have local residents pay for. In order to do this, it is recommended that a separate study be executed to determine those roads of the secondary & minor road network that should receive funding. This would, however, require that the following be carried out:

- Execution of a road inventory survey
- Execution of a road condition survey
- Definition of a core road network

Given the above lack of funds, **the RMLF should only be used for the maintainable road network and any road rehabilitation work should be financed by other sources including the donor community.** The JICA Study Team would like to note here that, if the Kenyan Government can draw up a plan detailing its core network and the possible scenarios for funding it and the non-core road network, together with better management via the full operation of the KRB system, **there should be no problems with obtaining outside funding to rehabilitate roads that the Government considers important.**

CHAPTER 6 PROPOSALS TO REALIZE AN EFFECTIVE ROAD MAINTENANCE SYSTEM

Based on the results of extensive on-site surveys and interviews, proposals that would increase the effectiveness of road maintenance and thereby eventually reduce costs to narrow the needs gap mentioned in Chapter 5 are described below. Note that the Kenya Roads Board (KRB) is to be the linchpin of the Kenyan road maintenance system and its success will determine whether or not an effective road maintenance system can be realized. As for the other proposals contained in this chapter, although important, they are supporting measures for the KRB and the road maintenance system as whole.

6.1 KRB Operability & Systemic Reform

The KRB Act was enacted on 1st July 2000 and the establishment of the KRB system itself is in progress. Changes or adjustments towards establishing the new system shall take place step by step to avoid confusion and counterproductive results. Accordingly, a transition period for the KRB to become fully operational is necessary. It is assumed that a minimum of three years is needed for this to be realized.

To detect the problems that the KRB system is encountering in this transition, the Study Team has carried out a number of surveys and hearings, with the most recent being an extensive set of interviews in May and June of 2002 (see “Monitoring & Evaluation Results” in Volume 3 of this report). This most recent work, as shown in Table 6.1, consisted of interviewing the KRB, district roads committees (DRCs), district roads engineers (DREs)/municipal engineers, and provincial roads engineers (PREs). As this table indicates, the Study Team met with many if not most of the major people involved in the operation of the KRB system.

Table 6.1.1 Number and Type of Respondent

Job Title of Interviewees/Respondents	Number of Interviewees/Respondents
Provincial Roads Engineer	8
District Roads Engineer	48
Member of District Roads Committee (excl. DRE)	7
Total	63

Based on the above, together with previous work that the Study Team has carried out, obstacles to the success of the KRB are described in the next section.

6.1.1 Obstacles to the KRB System

Although the Kenyan Parliament passed the KRB Act in 1999, the KRB itself was not fully staffed and outfitted until July 2002, and has only been in partial operation since November 2001. Even though only a short time has passed since becoming partially operational, the KRB's activities have resulted in monies being distributed to the constituencies of all 70 districts in Kenya for road maintenance, something that rarely if ever occurred previously, resulting in the KRB being highly evaluated. Despite this initial good start, the KRB is still not fully operational and this next year will determine whether or not the reform of the road maintenance system is a success. The obstacles still facing the KRB are categorized into 6 items and are described in detail below

(1) Funding

Under the KRB Act, 57%, 40%, and 3% of the money collected from the Road Maintenance Levy Fund (RMLF) is supposed to be allocated by KRB to the Roads Department (RD) of the Ministry of Roads and Public Works (MORPW), the DRCs, and to the KRB for administrative costs, respectively. Although money for road maintenance is now reaching the constituencies of all the 70 districts in Kenya, something that rarely if ever occurred previously, there are still problems and they are as follows:

- The above-mentioned 57% and 3% of KRB money is being distributed as originally intended under the KRB Act. On the other, the 40% that is supposed to be distributed to the DRCs is not being allocated as intended. That is, 24% of that 40%, which is supposed to be distributed equitably to the districts, is going to the RD to pay for a backlog of projects. In addition, no deadline has been given at present by the KRB for when this 24% will be paid to the DRCs.
- As for the 16% of the 40% that is to be distributed equally to all of the 210 constituencies in Kenya, this is being carried out as originally intended.
- On the other hand, even though the constituencies are receiving their 16%, the payments are irregular and in small chunks that make it difficult to carry out work efficiently. For example, the first payment of the 2001 fiscal year, which begins in July, was not disbursed until November. During these 5 months no work was being done. In addition, untimely disbursements affect areas with large seasonal changes, meaning that the lost time could even be greater.
- The Kenya Wildlife Service (KWS), is not eligible to directly receive funds under the KRB Act, which has resulted in the KWS receiving no monies for the classified roads in its parks and for the classified roads that provide access to these parks.
- The towns and cities under the Ministry of Local Government (MOLG), which is not

considered as a road agency under the KRB Act, have received very little or no money under the current KRB system. This is because the members of parliament are more interested in repairing roads in the residential areas of their constituencies where their voters are, resulting in the roads in inner cities and towns being neglected.

(2) Organizational Structure & Staffing

The KRB system, due to its newness, still faces a number of problems in terms of organization and staffing and are as follows:

- Due to lack of staff in the KRB secretariat, no auditing or follow-up of work has been carried out regarding the monies distributed by the KRB.
- On the other hand, although the KRB Act was passed into law approximately 2 years ago, the executive director of the secretariat was just appointed last November. Furthermore, KRB's secretariat will only be fully staffed starting from 1 July 2002. Therefore, the real test of whether or not the KRB system is a success will be this coming fiscal year of 2002/2003. It should be noted that even with these staffing restrictions, the KRB has carried out its work quite well.
- At the district level, almost none of the DRCs have offices of their own and many are using MORPW facilities. This can partly be attributed perhaps to a lack of consciousness of DRC members regarding the KRB concept, which encourages the DRCs to be an independent body.
- Almost none of the DRCs have hired any support staff, meaning that MORPW staff is being used to carry out DRC work. This presents problems in that the administrative costs for DRCs and the MORPW are difficult to separate, and there are cases where DRC money is being used to pay for unrelated MORPW overhead costs.
- Excluding the DREs, some DRC members are not aware of the operational details of the DRCs, indicating that the number of meetings for DRCs is insufficient (at present meetings are held quarterly), or that there is insufficient communication between DRC members.

(3) Maintenance Manuals

The JICA Study Team submitted 500 sets of road maintenance manuals, which consist of an Execution Manual, Inspection Manual, and Evaluation Manual, in February 2002 to the MORPW for distribution to PREs, DREs, and other KRB stakeholders. The problems that have been detected in the Team's monitoring work regarding the manuals are as follows:

- The manuals have rarely been used due to a lack of communication between the man in the field and the agencies in Nairobi (i.e., MORPW and KRB).
- Many DREs have also stated a lack of funding for using the manuals. For example, it

was mentioned that the frequency of inspection for certain maintenance activities is impossible due to a lack of vehicles and monies for their repair and operation.

- Also, from the Kenyan perspective, inspections seem meaningless since even if you carry them out you will not receive the necessary money to execute the required maintenance activities.
- Although DREs have attended workshops on the use of the maintenance manual, technicians have not received training and are therefore unable or reluctant to use the JICA manuals in the field.

(4) Work Programs

Under the KRB Act, work programs have to be submitted to the KRB in order for road agencies to receive funding. The problems that have been detected regarding these work programs are as follows:

- In the case of the DRCs, DREs draw up work programs that are transparent and reliable, due to the KRB giving a definitive budget. However, it has been also mentioned that the priorities for these work programs are sometimes influenced by politics too much as a result of the members of parliament (MPs) sitting on the DRCs.
- On the other hand, it has been mentioned by site staff that work programs for Class A, B, and C roads are not useful because they are not based on any clear budget. That is, the RD does not seem to provide in advance a budget for planning, resulting in some provinces/districts making unreasonable requests. Even when the work programs are reasonable, it is rare that the budget requested is received. This is acceptable if the reasons for receiving less are clear, but according to some people in the field, the RD does not or seems it cannot provide these reasons.
- The unit rates and description of maintenance activities are not standardized. This is important in order that everybody knows what is being referred to as well as whether or not the rates are reasonable.
- Most of the DREs said that they used no formulae in calculating the costs of maintenance activities, and usually based their figures on quotations from the private market.

(5) Data

Having the correct data, as well as the systems and software to store, analyse, and evaluate it, are crucial for the success of the KRB system. Some of the problems detected in respect to this are as follows:

- Almost all of the DREs had computers available to them. On the other hand, according to the DREs, the vast majority do not collect road condition data on a regular basis due

to a lack of funds, and none of them collect traffic data.

- Furthermore, no database program has been made available (either from the KRB or the MORPW) to the DREs.
- Presently, there seems to be no system for collecting and sending data from the field to KRB or the road agencies, making it impossible for the KRB or the road agencies to know the needs of provinces/districts. In addition, there is of course no plan of action for updating data should it be collected.

(6) Work Execution & Auditing

The work execution method and auditing work in progress or completed is vital to ensure that the KRB system function as intended. The problems detected in respect to this are as follows:

- Because of a lack of KRB staff, there has been no technical or financial auditing by the KRB for this past fiscal year, meaning that there has been no follow up to ensure that road agencies are performing as intended. This however should be remedied with the KRB having its full staff in place for the start of the new fiscal year on July 1st.
- DRC work is sometimes being executed using MORPW staff and resources. This is not ideal in that DRC monies are sometimes being diverted to pay for unrelated MORPW overhead costs.
- The untimely flow of cash, as well as the small disbursements, results in no work being done for months, adversely affecting the performance of the DRCs.
- Due to the inability of the Mechanical and Transport Depart to keep equipment operating or to replace obsolete equipment, it is necessary for DREs and PREs to contract out to private firms. This is expensive since the private construction market in Kenya as a whole is still underdeveloped.

6.1.2 Proposals for Removing Obstacles to KRB System

Proposals for removing or eliminating the obstacles to the KRB system are described in the 6 items below, which will result in the necessary systemic reform to make the KRB fully operational.

(1) Funding

The success in having 16% of the RMLF distributed in a transparent manner to all of the 70 districts in Kenya is an excellent first step for the KRB towards operating as originally intended. However, the KBR should try to set up a system that does not require going through the permanent secretary of the MORPW for the disbursement of monies to the DRCs or any other non-MORPW entities, since this just slows down the process unnecessarily. As a

transition step this is perhaps okay, but it is recommended that the KRB try to remedy this problem by the end of fiscal year 2002.

- It is recommended that KRB clearly define when the DRCs are going to be receiving their remaining 24% of the 40% of the RMLF due to them during the fiscal year of 2002/2003. It is also recommended that the RD backlog of projects that the KRB agrees to finance exclude any cost variations (i.e., increases).
- It is recommended that KRB apply the criteria it has developed (see 6.6 of Chapter 6) for disbursing the above-mentioned 24% once it is made available, which is needed by the DRCs to carry out important maintenance work that can not be addressed by the current 16% of the RMLF that they are receiving now. However, it should be recognized that the system for allocating money equitably may need fine tuning in order strike a balance between fairness and ease of understanding.
- Under the previous system, promised monies were sometimes never distributed. With the KRB system, the monies due to roads agencies are clear and the mechanism for disbursement relatively reliable, so this should present no problem. Based on this, it is recommended that consideration be given to allowing road agencies to proceed with their work when KRB funds disbursement is late so that maintenance work can be carried out efficiently.
- It is recommended that the KRB and MORPW, as well as any other related agencies, closely examine the proposal submitted by the KWS regarding classified roads that should be entrusted to it for maintenance so that the KWS can receive monies from the KRB beginning in fiscal year 2003/2004.
- It is recommended that the DRCs designate urban and town roads for the Ministry of Local Government (MOLG) to be responsible for under the KRB system so that the MOLG can receive the money it needs to maintain these roads, which are being neglected by the DRCs.

(2) Organization

- It is recommended that the DRCs and MORPW effectively utilize existing organizations with sufficient capacity to act as sub-agencies to carry out maintenance work on their behalf. Examples of such organizations include the KWS, the city councils of Nairobi, Mombasa, Kisumu, El Doret, and Nakuru, and perhaps local producers of agricultural products such as coffee, tea, etc.
- It is recommended that the Mechanical and Transport Department (MTD) carry out its planned rationalization as quickly as possible by referring to the rationalization plan contained in the JICA Study Team's Final Report. It should be noted that the longer the MTD waits the less attractive it will become as an organization and the more difficult it

will be to become autonomous entity. The above is crucial for assisting in the creation of a more competitive market in Kenya for the contracting out of maintenance equipment.

- With the termination of Swiss assistance, the Kisii Training Center is starting to experience financial difficulties. It is recommended that the Kisii Training Center draw up and implement a plan to become an autonomous entity so that it can deal with this problem in a proactive manner.

(3) Education

- It is recommended that all road agencies send their engineers and technicians to the Kisii Training Center in the future to be trained in the use of the JICA road maintenance manuals, and that they provide feedback to Kisii one year after finishing to ensure that they are performing as intended.
- In addition to the above, it should be emphasized that the concept of the KRB is still not correctly understood by some of the road agencies and their staff. It is recommended that the KRB send out a memo clarifying and explaining its mission, vision, and strategy to all stakeholders, as well as hold regular meetings. *The KRB should also, for example, send out a memo informing all stakeholders that the JICA road maintenance manuals are “ready for use”.*

(4) Facilities/Equipment

- It is recommended that the DRCs obtain their own facilities by the end of the 2002/2003 fiscal year, so that they may become more independent as originally intended under the KRB Act. This will require that the DRCs consider the staffing of these facilities. It is recommended that the KRB and the MORPW discuss staffing at the district level so there is no unnecessary overlapping. Ideally, this should result in a slimmer MORPW with some staff transferring from MORPW to DRCs.
- It is recommended that all of the DRCs, each of which received a computer from KRB, link up with KRB and with each other via e-mail so that data and information can be reliably exchanged.

(5) Data

- It is recommended that road condition and traffic data be obtained from all districts and sent to the KRB for planning purposes via a rapid condition survey. This is necessary since it seems that the current World Bank road condition survey will still take some time to complete. In addition, the World Bank survey is only for classified roads, which are less than half of the total road network. Data for the unclassified network is also necessary for proper planning.
- It is recommended that the KRB obtain information not only on road conditions and road

traffic, but on road re-classification and kilometre markers as well (to be installed if necessary) in order to carry out planning.

(6) Communication

- Communication between the KRB and the road agencies still has much to be desired and it is therefore recommended that a reporting system be set up. For example, it is suggested that the minutes of meetings of working committees (or at least a summary) be sent to all road agencies and their staff so that they understand what is going on and to create a common understanding.
- It is recommended that a system for collecting, sending, and updating data be established between the KRB and the road agencies so that allocation of monies can be carried out accurately. According to KRB, the Swedish International Development Cooperation Agency (SIDA) will be providing funding for the implementation of a reporting and road maintenance work plan system.
- It is suggested that the KRB consider a system for updating and revising the road maintenance manuals to be submitted by the JICA Study Team in January 2003, so that important and timely changes can be made to the manuals as required.
- It is recommended that the manuals working group be the forum for further development of the manuals. This group should be lead by KRB and should involve all road agencies and interested parties. It might be beneficial to invite donors in the road sector such as SIDA and DANIDA to participate to ensure the manuals develop with full input from all those involved and that a single manual for Kenya is the outcome.

(7) Maintenance Equipment & Materials

It is proposed that the MTD be commercialized and reorganized into an autonomous organization under the MORPW during a transition period of three years. After that, based on the performance of the MTD during that period, the privatization of MTD into a completely independent entity can be considered. Details on the actions that should be taken during the transition period are described below.

1) Retrenchment of the MTD

Retrenchment of Equipment

In order to deal with the shortage of funds facing the MTD, the Study calculated trial estimates for reductions in the total number of pieces of equipment. The totals applied for these estimates are 2000, 1500, 1000, and 500. Below, the results of the estimation are summarized in Table 6.1.2 to 6.1.6

Table 6.1.2 Estimated Expenses for 2000 Pieces of Equipment (unit: Ksh.)

Item	Year 1	Year 2	Year 3	Total
Purchasing of Equipment	665,090,000	698,340,000	733,260,000	2,096,690,000
Maintaining of Equipment	432,630,000	692,410,000	977,080,000	2,102,120,000
Rehabilitation of Equipment	249,500,000	261,980,000	275,080,000	786,560,000
Provision for Replacement of Equipment	557,650,000	557,650,000	557,650,000	1,672,940,000
Total	1,904,870,000	2,210,380,000	2,543,070,000	6,658,310,000

Table 6.1.3 Estimated Expenses for 1500 Pieces of Equipment (unit: Ksh.)

Item	Year 1	Year 2	Year 3	Total
Purchasing of Equipment	226,320,000	237,640,000	249,520,000	713,480,000
Maintaining of Equipment	431,310,000	594,040,000	771,970,000	1,797,320,000
Rehabilitation of Equipment	188,560,000	197,990,000	207,880,000	594,430,000
Provision for Replacement of Equipment	418,240,000	418,240,000	418,240,000	1,254,710,000
Total	1,264,430,000	1,447,900,000	1,647,610,000	4,359,930,000

Table 6.1.4 Estimated Expenses for 1000 Pieces of Equipment (unit: Ksh.)

Item	Year 1	Year 2	Year 3	Total
Purchasing of Equipment	107,100,000	112,450,000	118,080,000	337,630,000
Maintaining of Equipment	411,980,000	484,400,000	563,030,000	1,459,410,000
Rehabilitation of Equipment	63,890,000	67,080,000	70,440,000	201,410,000
Provision for Replacement of Equipment	278,820,000	278,820,000	278,820,000	836,470,000
Total	861,790,000	942,760,000	1,030,370,000	2,834,920,000

Table 6.1.5 Estimated Expenses for 500 Pieces of Equipment (unit: Ksh.)

Item	Year 1	Year 2	Year 3	Total
Purchasing of Equipment	41,180,000	43,240,000	45,400,000	129,820,000
Maintaining of Equipment	249,430,000	270,980,000	294,060,000	814,470,000
Rehabilitation of Equipment	6,020,000	6,320,000	6,630,000	18,970,000
Provision for Replacement of Equipment	139,410,000	139,410,000	139,410,000	418,240,000
Total	436,040,000	459,950,000	485,500,000	1,381,490,000

Table 6.1.6 Comparison of Expenses for Different Equipment Totals (unit: Ksh.)

Pieces of Equipment	Year 1	Year 2	Year 3	Total	% (Trial /Original)
Original Desirable Case (3066 pieces)	3,410,060,000	4,180,630,000	4,814,990,000	12,405,680,000	100.0
2000 pieces	1,904,870,000	2,210,380,000	2,543,070,000	6,443,840,000	51.9
1500 pieces	1,264,430,000	1,447,900,000	1,647,610,000	4,359,930,000	35.1
1000 pieces	861,790,000	942,760,000	1,030,370,000	2,834,920,000	22.9
500 pieces	436,040,000	459,950,000	485,500,000	1,381,490,000	11.1

From the comparison in Table 6.1.6, it can be seen that a reduction in the number of pieces of equipment is very effective for cost reduction. That is, a decrease in equipment to approximately 16% of the original (i.e., 3066 pieces/500 pieces), brought costs down to 11.1% of the original estimate. In addition to carrying out trial cost estimates for reductions in the total amount of equipment, the value of sales of surplus equipment is also worked out as shown in Table 6.1.7. As a result of selling surplus equipment after retrenchment to 500 pieces of equipment, revenue of Ksh. 646,530,000 can be expected.

Table 6.1.7 Estimated Value of Sales of Surplus Equipment (unit: Ksh.)

Pieces of Equipment	Pieces of Equipment Sold			Total Value
	Serviceable	Under Repair	Unserviceable	
Original (3066 pieces)	0	0	1773	187,650,000
2000 pieces	0	144	1773	214,470,000
1500 pieces	5	345	1773	274,120,000
1000 pieces	125	571	1773	415,550,000
500 pieces	438	661	1773	646,530,000

Retrenchment of Staff

In fiscal year 2000, the amount requested for staff wages was Ksh. 277,603,234. On the other hand, only Ksh. 191,173,853 was actually allocated for this purpose. In addition to this, with the large retrenchment of equipment, many workshops in the provinces/districts can be abolished or merged with other workshops. Due to these reasons, a reduction in the number of staff will be necessary.

Establishment of Regional/Sub-regional Mechanical Workshops

The current Provincial Mechanical Workshops (PMW) and District Mechanical Workshops (DMW) shall be replaced by Regional Mechanical Workshops (RMW) and Sub-regional Mechanical Workshops (SRMW). RMW shall be established at the same locations as the Regional Road Offices (RROs) of the Roads Department (RD) while RROs are proposed to establish on the basis of provincial headquarters, since it is expected that the RROs will be the prime clients of the MTD. Basically, a RMW shall handle 2 SRMWs in its jurisdiction. Existing PMW equipment shall be transferred to the RMWs. Furthermore, SRMWs will come under the charge of the RMWs, and the existing equipment of DMWs will be transferred to SRMWs. Due to this, the existing 70 DMWs shall be replaced by 16 - 20 SRMWs to achieve a highly effective cost reduction regarding workshop management.

2) Leasing Revenue

The leasing of equipment is the only permanent revenue source for the commercialized MTD. In recent years, however, MTD has received no revenue from this activity due mostly to non-payment. The Study estimated the potential leasing revenue in Table 7.4.7 using records from the PWOs/DWOs for fiscal year 2000.

**Table 6.1.8 Summary of Estimated Revenue by Province
for FY 2000 from Leasing (unit: Ksh.)**

Province	Pcs. of Leased Equipment	Estimated Revenue
Nairobi	13	19,953,044
Central	79	79,246,804
Coast	44	15,420,599
Eastern	34	28,597,415
North Eastern	28	36,332,177
Western	35	60,451,259
Rift Valley	60	82,183,946
Nyanza	62	200,287,864
Total	355	522,473,109


Note: 355 units were leased with a serviceable stock of 865 units.

According to Table 6.1.8, total revenue of approximately Ksh. 522,473,109 should be possible for MTD to achieve with the Roads Department as its customer. Leasing to other users (e.g., KWS, local authorities, Forest Department, private firms) makes it possible to increase this amount in the future. Note that the establishment and enforcement of rates are crucial.

3) Action Plan

During the 3-year transition period of re-organization, the actions below should be taken.

- (i) Retrenchment of current equipment stock


3325 pieces  500 pieces

- (ii) Sales of surplus equipment items

Ksh. 646,530,000 is expected.

- (iii) Rationalization of staff

Staff and administration cost should be cut by 50 % of the current amount requested.

Ksh. 277,603,234 (FY2000)  Ksh. 138,801,617

- (iv) Establishment of Regional/Sub-regional Mechanical Workshops

8 – 10 RMWs and 16 – 20 SRMWs

(v) Commencement of leasing system

Potential users (DRCs, KWS, FD, LAs etc) should be opened up.

Based on the above recommended actions, the estimated expenses and revenue over the 3-year transition period for MTD are as listed in Table 6.1.9.

Table 6.1.9 Estimated Expenses/Revenues of MTD in Transition Period (unit: Ksh.)

Expense/Revenues	Item	Year 1	Year 2	Year 3	Total
Expenses	Administration	208,202,426	166,561,940	138,801,617	513,565,983
	Purchasing/Maintaining of Equipment	436,040,000	459,950,000	485,500,000	1,381,490,000
	Total	644,242,426	626,511,940	624,301,617	1,895,055,983
Revenues	Sales of Surplus Equipment	646,530,000	-	-	646,530,000
	Leasing Fee	-	600,844,075	690,970,687	1,291,814,762
	Total	646,530,000	600,844,075	690,970,687	1,938,344,762
Balance		(+) 2,287,574	(-) 25,667,865	(+) 66,669,070	(+) 43,288,779

4) Materials

The quality of materials is a crucial factor for roads work. Presently, the Materials Testing & Research Department (MTRD) under the MORPW is responsible for this work for the classified road network. Although MTRD can satisfy the testing needs of this network, organizational changes may be required for MTRD to handle demands that will be made on it by the KRB system, since it encompasses both the classified and unclassified road network.

Technology Development

Black cotton clay is the most problematic soil layer in Kenya. Generally, this kind of soil layer is removed from roadbeds. However, in the case where the layer is extremely thick, it may be impossible to remove. Therefore, technologies to carry out measures such as pre-loading settlement, geo-textile netting, etc. should be developed in Kenya.

6.2 Development of Road Maintenance Training Plan and Capacity Building

The phasing out of force-account work in favor of contracting out is an unstoppable process because of the gains in cost efficiency and the effectiveness of manpower usage. Therefore, the future of road maintenance rests on developing private contractor capacity, especially that

of small- to medium-scale contractors. In this regards, a training program for the development of the managerial capacity of officials and engineers and education for contractors are presented in this section. The training plan advocates a combination of labor and light/intermediate equipment, with emphasis on cost effectiveness. As well as being cost-effective, the approach is also in line with the Government's Road Sector Strategy and Poverty Reduction Strategy.

6.2.1 Road Maintenance Training Plan

The Road Maintenance Training Plan has been designed to fit in with the new arrangements for undertaking road maintenance works – namely, KRB and the Road Agencies. The Training Plan shall take account of the key policy framework and directions that govern the roads sector. These are as follows:

- The Road Maintenance Initiative (RMI).
- The Strategic Plan for the Roads Sector.
- The Roads 2000 maintenance program.
- Kenya's Poverty Reduction Strategy.
- The vast majority of road maintenance being contracted out to the private sector.
- Force account being phased out with some exceptions during the transitional period; namely, skeleton force-account units to cover emergencies, locations facing a security risk, and areas having a sparse population/lack of labor. Eventually, force account can be completely phased out except in security-risk areas.

The Training Plan can be managed, executed and monitored by the Kisii Training Center (KTC), under the umbrella of the Kenya Institute of Highways and Building Technology (KIHBT). There will be three main ways of delivering training – courses held in Kisii, field activities across the country to compare Kisii best practice with ongoing maintenance works, and portable courses mostly held in provincial capitals.

Road Agencies to be Trained

KTC's core clients for training during the transition period will be:

- Labor-based, small-scale contractors
- LBES medium-scale contractors
- Roads Department (RD) staff at province level.
- KWS staff.
- RD staff at district level.
- Local Authority (LA) Level – LA staff.

- Persons participating in community-based road maintenance projects in rural areas and in urban low-income settlements.
- Mechanical and Transport Department (MTD) staff – with a focus on equipment-based technology for selected periodic maintenance activities (e.g., surface works on paved roads) and routine maintenance works in sparsely populated areas (lack of labor) and in security risk areas where an equipment-based approach would result in quicker execution of works.

Although some training for local authorities is being provided under the World Bank’s KUTIP project, the local authority level is still seen as a core client because of the need to reach sustainability beyond the scope of KUTIP. Non-core clients can be accommodated as necessary based on demand – namely, MORPW/RD Headquarters (e.g. for materials testing, road condition surveys and traffic counting), the Forest Department, the Sugar/Tea/Cereal/Coffee entities, and consulting firms interested in site supervision.

Core Training Courses for Transition Road Agencies and MTD

KTC’s core training courses for road agencies and MTD will cover the following subjects (a combination of rapid refresher courses and 2 – 4 week full courses):

- Contract administration for RD – Class A/B/C roads.
- Site supervision for RD – Class A/B/C roads.
- Contract administration for RD district-level staff – Class D/E/Rural Access roads.
- Site supervision for RD district-level staff – Class D/E/Rural Access roads.
- KWS staff can join the RD courses.
- Contract administration for LA staff – local authority roads.
- Site supervision for LA staff – local authority roads.
- Mechanical (equipment-based) training for MTD staff – technical training for routine and periodic maintenance, as well as commercial training in the context of MTD becoming a provider and lessor of heavy-type equipment. As necessary, KWS can join the MTD courses. To provide a better focus for mechanical activities, equipment-based training will be shifted from Ngong to the Kisii campus.
- Road Agencies – courses for the preparation of road maintenance work plans.
- Road Agencies – classroom and site training for users of road maintenance manuals.

Core Training Courses for Small/Medium-Scale Contractors

KTC’s core training courses for small/medium-scale contractors will cover the following subjects (courses of 2 to 4 weeks plus follow-up activities in the field, including trial contracts and mentorship):

- Contract and business management – for owners/senior members of firms.

- Sub-contracting.
- LBES operations.
- Maintenance of light/intermediate equipment.
- Operations using labor/hand tools (without light equipment).
- Site management – for contractors’ site supervisors/foremen/headmen.
- Community-based road maintenance works in rural areas.
- Community-based road maintenance works in urban low-income settlements.

KTC - Proposed Preparatory Phase – January to June 2002

During the first quarter of 2002, KTC personnel will visit each province in order to carry out a training needs assessment. The assessment will concentrate on the Roads Department – namely RD’s provincial level staff (PWOs, PREs and lower levels) and district level staff (DWOs, DREs and lower levels). The assessment will determine two things – which staff need training (full courses or refreshers) and in what subjects (based on the core courses). Then a training program will be drawn up for fiscal years 2002/03 to 2004/05. The program will specify the persons to be trained and the timing of the training. Under the program, each province will be treated equally, rather than one or more provinces getting priority. The first year of the program will be specified in more detail than the other two years, leaving room for flexibility based on lessons learned during year one. Senior staff will be trained first in order to facilitate dissemination – from the top to the lower ranks. **This particular training program for RD will be priority number one.**

During the second quarter of 2002, KTC personnel will visit each province in order to hold seminars with district-level stakeholders (i.e., the district stakeholders would be invited to assemble in the provincial capital). The stakeholders would include: District Development Committees and DRC representatives, agricultural enterprises (e.g., coffee/sugar/tea/wheat representatives), potential small/medium-scale contractors, interested NGOs, RD staff, any ex-headmen/lengthmen, and other grass-root groups. The seminars would explain the new KRB arrangements and the need to develop small/medium-scale contracting. The training courses available to contractors would also be explained and publicity materials handed out for subsequent circulation in the districts. Following the seminars, it is intended that KTC would be in a position to sketch out a training program for small/medium-scale contractors. **The program for developing private contractors will be priority number two.** It is considered that this training program would have to be prioritized in order to see which provinces should be addressed first. Factors for consideration will include: characteristics of the road network, topography, expected volume of road maintenance work to be contracted out, population density, availability of labor and agricultural potential.

KTC Action Plan 2002

Training at Kisii for persons from overseas is declining quite fast. Thus, it is an opportune moment for KTC to re-focus its strategy – namely, its core activity for the foreseeable future should be to provide training for Kenyan road agencies and small/medium-scale contractors.

Key Action

Key action for 2002 is seen as follows:

- Carry out the training needs assessment for Roads Department (RD) staff, including the preparation of the necessary dissemination/publicity materials.
- Draw up a training program/schedule for RD staff for FY 2002/03 – this should cover all PWOs, PREs, DWOs and DREs – a total of about 156 persons to be trained in one year (2002/03). KWS staff would be invited to participate.
- Draw up a training program for other RD staff for FY 2002/03 – these persons would mainly be district level supervisors/inspectors. On average, each district has three of these people – giving a total training demand of about 210 persons. In FY 2002/03, KTC could train about 70 of these (one from each district), with the balance being covered in 2003/04 and 2004/05. Selection will be based on seniority (i.e. senior first). KWS staff would be invited to participate.
- At any one time KTC can accommodate 60 trainees on campus. Given this, a likely spread of courses in 2002/03 is as follows – two courses for the 16 PWOs/PREs (8 persons each time), four courses for the DWOs/DREs (35 persons each time), and two courses for the first batch of supervisors/inspectors (35 persons each time).
- Make all necessary refinements to the existing course materials (e.g., sub-contracting), and liaise with KRB with a view to getting standard contract documents (LBES and equipment-based). For a standard LBES contract document, a good starting point might be the short-form FIDIC document drafted in 1998.
- Visit provinces to hold seminars with district-level stakeholders, including the preparation of the necessary dissemination/publicity materials. Then, prepare a training program/schedule for small/medium-contractors for 2002/03. This area is less predictable than the program for RD, but hopefully the picture will become clearer at and after the seminars. In any event, KTC has good experience of how to mobilize potential contractors (including the Danida Coast project).

6.2.2 Private Sector Capacity Building

Guiding Principle

Force account is being phased out for two reasons: firstly, the civil service downsizing program; and secondly the inherent inefficiency of works undertaken by force account. Therefore, the success of the new KRB system hinges on Kenya developing its own road maintenance contracting industry, especially small/medium-scale contracting.

Contractor Access to Resources

1) Access to Credit

- Commercial banks are generally reluctant to offer credit to small/medium contractors without collateral or sureties (which contractors do not possess). Therefore, the Contractors Association, contracting agency and/or funding agency (in our case, KRB/Road Agencies) has an important role to play in assuming some of the financial risk. Also, small business credit agencies could be considered for playing a role in providing credit – for example, Kenya Rural Enterprise Program Bank (KREP Bank) might be a good starting point.
- Labor-based contractors usually require less start-up capital than equipment-based companies. For example, contract advances may be all that is necessary for some routine maintenance contracts, and regular interim payments for the payment of wages would go a very long way in easing contractors' cash flow problems.
- At least during the transition period, KRB (probably through the Road Agencies) should consider giving credit guarantees to banks or suppliers basing on an evaluation result of the contractors capability and performance, and making direct payments to banks/creditors from interim certificates. Suppliers could supply items such as materials, tools, light equipment and pick-up trucks.
- Equipment suppliers and agents could be encouraged to operate hire-purchase agreements for contractors, if they were given suitable guarantees by KRB.

2) Access to Tools, Equipment and Spare Parts

- It is essential to ensure that appropriate plant and equipment in working order is available to all contractors, so that scarcity does not distort hiring costs. Most contractors aspire to own some equipment. However, the purchase of equipment implies a heavy financial burden on contractors, which is likely to necessitate a guaranteed workload to facilitate repayment. Therefore, purchase and lease options need to be balanced in terms of available funding, workload, access to finance and

contractor capacity to grow.

- An advance mobilization payment of 10 – 20 % of the contract value could be considered for inclusion in the contract to provide the contractor with the opportunity to buy second-hand equipment. It could be stipulated that all or part of this advance payment would be payable to equipment suppliers only, on written justification by the contractor. This approach would provide a credit line to the contractor, while giving the option to prioritize the acquisition of essential equipment, as well as the types and models to purchase.
- In the context of private sector capacity building, KRB/Road Agencies have a responsibility to ensure fair and reasonable financing terms and conditions for contractor access to equipment. Therefore, KRB/Road Agencies may need to provide certain guarantees to banks or suppliers in order to obtain reasonable terms and conditions.
- KRB/MTD could play a role in establishing a public or private sector plant pool facility to ensure equipment availability. This approach could be tried for heavy-type equipment, but is probably not suitable for the light/intermediate equipment that would be needed by small/medium-scale contractors.
- Equipment leasing companies could be established to provide a complete service to contractors.
- The local manufacture of light equipment and hand tools should be encouraged. This is likely to require positive action from KRB/Road Agencies in the form of raising awareness of the need for good-quality, well-designed hand tools and light equipment. Also, procurement should be biased towards local suppliers, as long as these can provide quality items and back-up services.
- Discussions on the choice and comparative costs of equipment, as well as realistic equipment costing models, should be introduced during contractor training. This is essential to create an awareness of true equipment costs and to enable contractors to tender realistically and compare technology options.

3) Access to Materials

- Sometimes materials are scarce. In such instances, KRB/Road Agencies may be able to issue permits to contractors for access to material supplies.
- Also, payment guarantees could be given to private suppliers before supplying contractors.
- However, ultimately contractors need to operate in the realities of the materials market, and credit lines should be opened between suppliers and small/medium contractors.
- Bulk-buying by the Road Agencies will almost certainly have to be continued in the

transition period. Also, contractors might be able to pool together in order to get discounted prices for materials.

4) Access to Works

- Contractors with financial commitments (e.g. equipment loans they have been encouraged to take on) are likely to need special consideration for guaranteed work, at least for the period when they have to make loan repayments.
- KRB/Road Agencies could consider packaging works contracts to suit small/medium contractors, as well as encouraging them to pool together in order to be able to bid for term contracts. However, a balance needs to be struck between promoting small/medium-scale contractors and the need to avoid thousands of micro-contracts that would be impossible for KRB/Road Agencies to manage. KTC will be able to advise KRB/Road Agencies on this critical issue. Also, large/general contractors could be encouraged to sub-contract to the small/medium-scale outfits.
- In the transition period, a specific allocation of road maintenance works could be made to LBES small/medium contractors who have passed through a KTC training program – for example by starting with D/E/Rural Access Roads and community-based works under the 16 per cent fuel levy allocation to constituencies.
- The need to improve the transparency of the legal environment and procedures should be looked at. A certain amount of protection of emerging contractors is likely to be required in the transition period. For example – after passing through the KTC training program and the successful completion of a trial contract, a new contractor should automatically be given a term contract of at least one year (probably fixed rates/engineer’s estimate) without having to submit a bid. Six months is not enough continuity, especially if the contractor needs to buy a pick-up truck and other items.
- On expiry of the first term contract, the contractor would have to bid along with the competition. **In addition to access to credit, the matter of access to works (particularly the first term contract) is absolutely vital. Otherwise training is just wasted, as has been the case with the currently dormant Roads 2000 projects (excluding Danida). In other words, the process for realizing “access to works” needs to be institutionalized between KTC and KRB/road agencies.**
- One way to minimize the number of term contracts would be to put two or more small contractors together – starting from the initial KTC training and then right through to the end of the first term contract. A good starting point for implementing this concept would be routine road maintenance on Class D/E/Rural Access roads.
- In the initial stages of contractor development, it is unlikely that there can be a genuinely competitive bidding situation, because there will be more road maintenance

works than available contractors. Also, a certain period of protection of trained contractors is needed for them to become established in the market. Competitive bidding, when introduced too early, can eliminate potentially competent contractors. Contractors all need good worksite experience (not less than 12 months) to gain sufficient practical information for the competitive bidding process. Accordingly, access to a first term contract can be regarded as being the final training/mentorship stage.

6.3 Development of Road Maintenance Manual for Capacity Building

KRB was established in July 2000 and is responsible for the maintenance of all public roads in Kenya. It is therefore hoped that consistency in the field of road maintenance will be achieved in Kenya via KRB's application to all of its roads of the road maintenance manual developed by the Study Team.

Road infrastructure is one of the necessary fundamental factors for improving the socio-economic performance of a nation. Because of this, it cannot be stressed enough that proper maintenance after the completion of road construction is therefore essential. To consistently ensure road maintenance of a sufficient quality, it is important that the engineers, inspectors, technicians, etc. involved in road maintenance use the same methodologies and tools. The purpose of the maintenance manual is to ensure such consistency by providing standard methodologies and tools based on the experiences and characteristics of Kenya.

The road maintenance manual is comprised of the following three volumes:

- Part I: Inspection Manual
- Part II: Evaluation Manual
- Part III: Execution Manual

6.3.1 Manual Composition

Inspection Manual

The Inspection Manual describes the inspection methods for inspectors and contains the following:

- Inspection sheets
- Defect descriptions
- Frequency of inspection
- Safety methods during inspections

Evaluation Manual

The Evaluation Manual describes the evaluation methods for defects and the selection methods for repair works. This manual is prepared for engineers and contains the following:

- Evaluation standards
- Selection methods for execution of maintenance works

Execution Manual

The Execution Manual describes the methods for repair works, cleaning and clearing based on the evaluation results. This manual is prepared for engineers and contains the following:

- Contents of each execution method
- Safety method during execution of works

6.3.2 Types of Maintenance

There are three types of road maintenance and they are as follows:

Routine Maintenance

Maintenance requiring execution once or more times per year on a section of road and that is typically small in scale or simple, but widely dispersed and requiring skilled or un-skilled manpower. The need for some routine maintenance can be estimated and planned on a regular basis (e.g., vegetation control).

Periodic Maintenance

Maintenance occasionally required on a section of road after a number of years and that is normally large in scale and usually requiring the temporary deployment of special equipment and skilled resources for implementation. Periodic maintenance is costly and requires specific identification and planning for implementation and often requires design work as well.

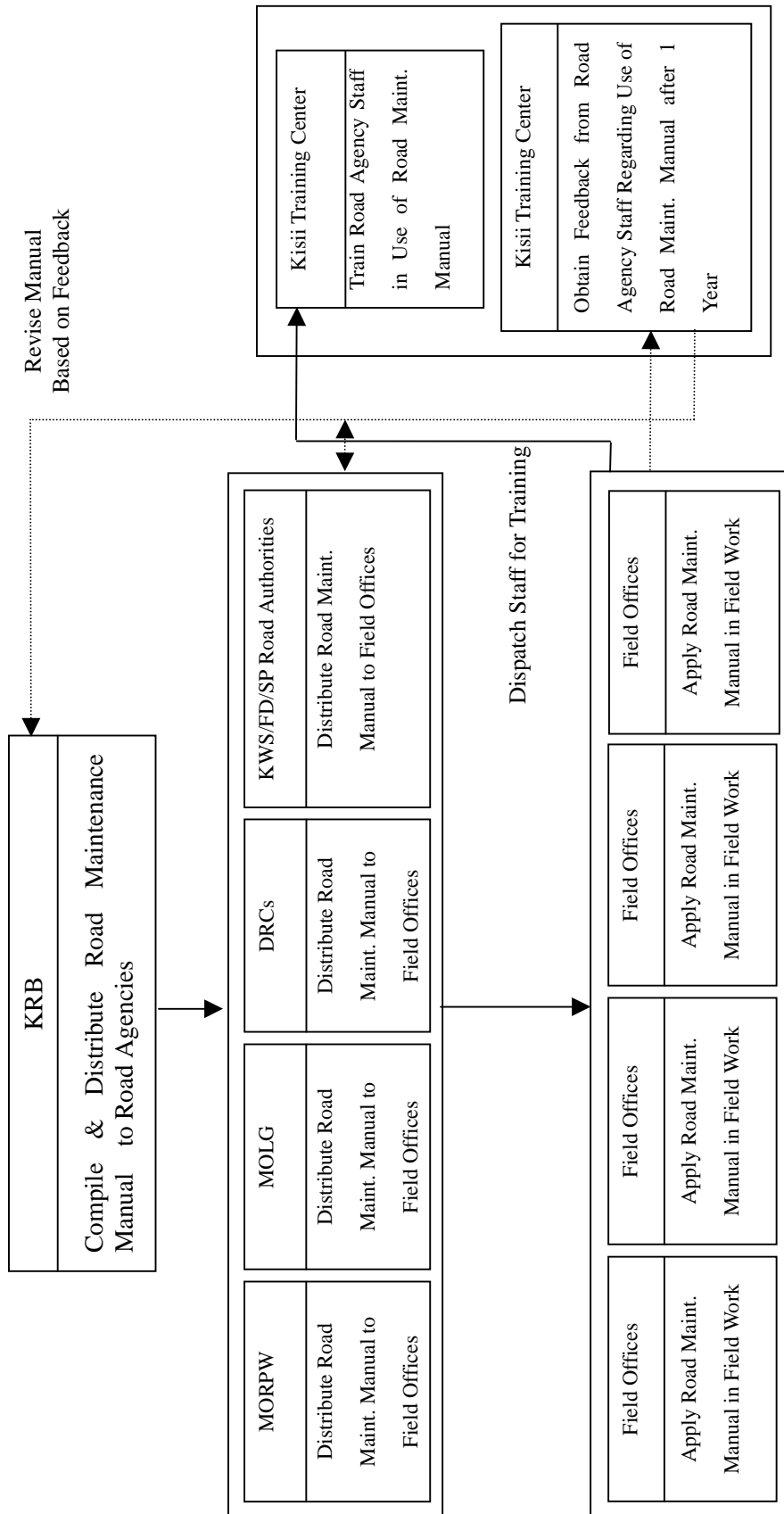
Urgent Maintenance

Certain unforeseen situations that necessitate remedial maintenance to be taken as soon as possible (e.g., flood damage, slips).

6.3.3 Training of Kenyan Engineers in Use of Maintenance Manual

As mentioned previously, it is recommended that the Kisii Training Center (KTC) design and carry out training (see ANNEX 11), which will include on-site practice, using the JICA road maintenance manual as a standard. In order to achieve the above-mentioned standardization, it is recommended that all road agencies send their engineers and technicians to the KTC to be trained in the use of the manual, which was developed in a cooperative effort between JICA and the Kenya Roads Board, the Kenyan Ministry of Roads and Public Works, the Kenyan Ministry of Local Government, Kenya Wildlife Service, and the Nairobi City Council. Moreover, it is also suggested that trainees provide feedback to Kisii one year after finishing to ensure that they are performing as intended.

Finally, the road maintenance manual should be updated periodically to reflect changes in the field of road maintenance or to make necessary modifications, revisions, or corrections. It is recommended that the Kenya Roads Board be responsible for keeping digital copies of the three volumes of the manual at its office in Nairobi so **official** versions of the manual can be distributed as required. The process depicting the distribution, training in the use of, and revision of the JICA road maintenance manual is as shown in Figure 6.3.1 below.



Note:> denotes feedback

Figure 6.3.1 Flow Chart for the Distribution & Updating of Road Maintenance Manual

CHAPTER 7 RECOMMENDATIONS

As indicated in the previous chapters, the Study has proposed a comprehensive and holistic program to realize an efficient and effective road maintenance system, based on an analysis of funding for road maintenance and plausible future road maintenance scenarios in Kenya. The key recommendations to achieve the goal of making the system fully operational, which is in accordance with the framework of the Kenya Roads Board, are as follows:

- (1) **Road inventory data, road condition data, and traffic data need to be updated urgently and continuously** to enable sensible decisions regarding maintenance, as well as to provide a basis for the justification of the allocation of funds.
- (2) **Maintenance information/data should be retained on a user-friendly computer database** to enable engineers to monitor and analyze maintenance activities and costs for each type of road surface. There should also be a system for checking and updating data as well. Finally, the maintenance manual developed by the JICA Study Team should be kept in digital format and updated as indicated previously. KRB will be responsible for distributing and updating the manual and will hold its copyright.
- (3) **The design and quality of construction of original pavement needs to be strictly controlled** to ensure maximum pavement life in order to get value for money from investment in road infrastructure.
- (4) **Legal and institutional setup for road maintenance that includes finance, management and technical issues** need to be resolved based on the issues identified by the “Interim Steering Group” as soon as possible. In conjunction with this, the reform and reinforcement of road-related organizations in order to implement the KRB system as intended is to be carried out.
- (5) **A national system of guidance for the preparation of Work Plans** is required, including a review of unit rates for maintenance works.
- (6) **Standard contract documents need to be put in place for LBES works (simplified form of contract) and perhaps for equipment-based works** to encourage small-scale contractor participation in road maintenance. It is also important that there is a system to review and update this documentation.
- (7) **Mechanical and Transport Department (MTD)** has the potential to provide equipment services for both the public and private sector if rationalization and commercialization are urgently carried out.
- (8) **Kisii Training Center (KTC)** has the capacity to develop new training products (courses), and the training plan can be managed, executed and monitored by KTC (see ANNEX 11), but financial support shall be required. It is suggested that KTC also develop new sources of revenue to supplement its cash flow.

- (9) **Promotion of private sector capacity building** is crucial and small/medium-scale contracting needs to be assisted in two major areas: **access to resources** (i.e., credit, work, equipment, materials) and **establishment of an enabling environment for contracting** (i.e., prompt payment, simplified contracts, establishment of a contractor's association and contractor registration, and evaluation procedures).
- (10) **It is suggested that JICA or some other international donor carry out a Pilot Study over a period of 1 to 2 years** with the purpose of monitoring and assisting with the implementation of the recommendations made in this Study. The Pilot Study would select a few districts for this work, which would then serve as a model for KRB and the rest of Kenya. Execution of the Pilot Study would be carried out with the support of Kisii Training Center, which would be in charge of training and would receive funding from KRB and/or the Donor as part of this work.
- (11) To execute item (10), which will ultimately determine the effectiveness of all funding for road maintenance (including international funding), **it is suggested that a long-term expert from either JICA or another international agency be dispatched to KRB**. Note that the expert to be effective will have to possess a combination of skills that includes engineering, organizational development, and negotiating capabilities.

Having considered the various issues and recommendations stated previously, it is suggested that said issues and recommendations be resolved and implemented over a three-year period (2002 – 2005) in order to prevent the further deterioration of road conditions via the implementation of maintenance as required under the framework of the Kenya Roads Boards. The suggested implementation program for the three-year transition period to achieve this is as shown in the bar chart in Figure 7.1.

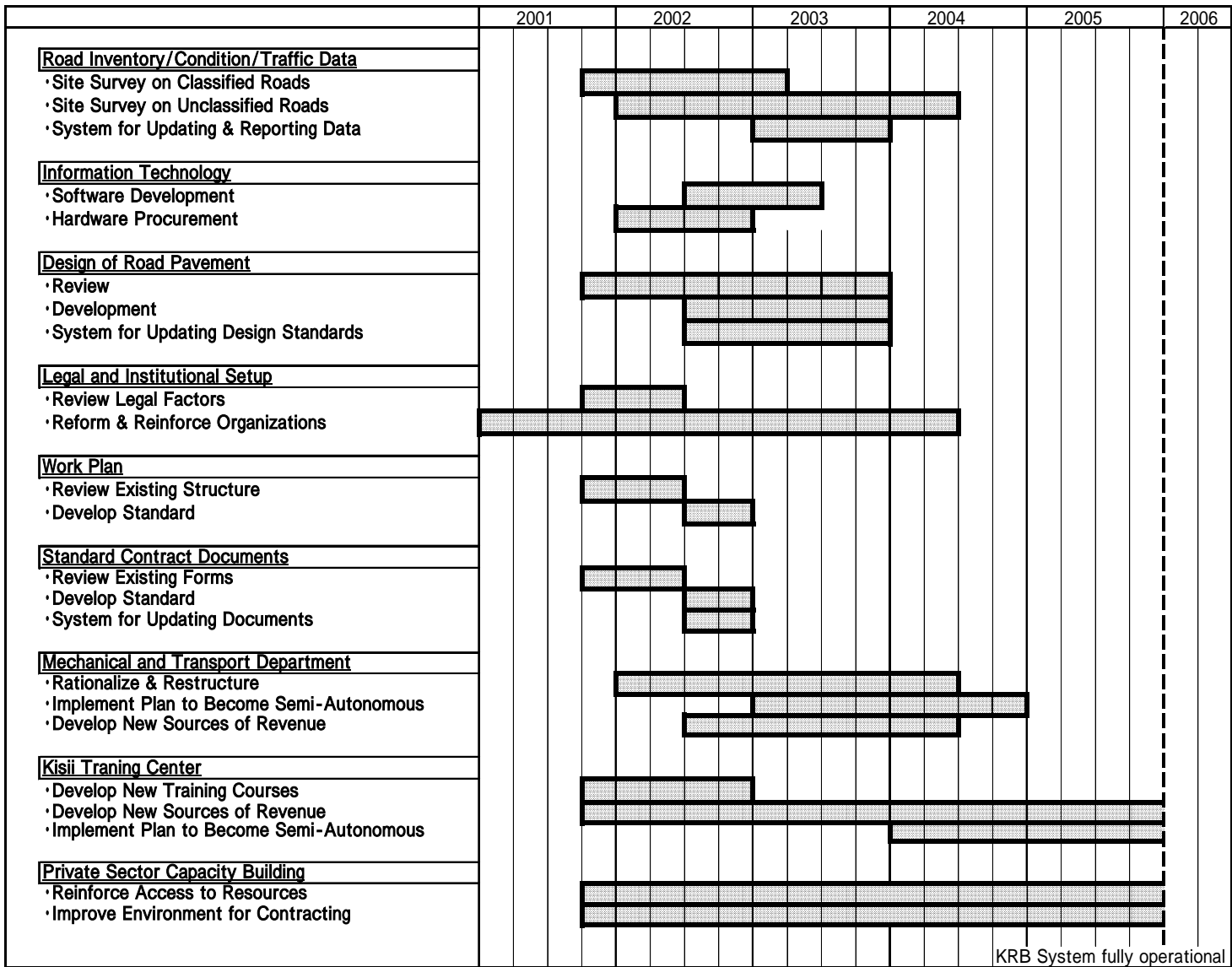


Figure 7.1 Implementation Program for Transition Period