17.4.4 Noise

(1) Estimation

1) General

With the increase of road traffic in Dar es Salaam, noise will affect the residents along the roads. Also, noise generated by road construction activities will affect the residents.

Traffic noise and construction noise have been studied on the priority roads by utilizing a theoretical equation with the considered factors listed below.

- Items considered

  Road traffic noise : central value of noise level (L_{50})

  Road construction noise : noise level (mean of the maximum values)

- Years considered

  Road traffic noise : 2000

  Road construction noise : during the construction

- Roads and road width considered

  Same as in the estimation of the air pollution

2) Method of Estimation (see Appendix 17.4)

a. Road traffic noise

Road traffic noise was estimated at 1.2 meters above the ground next to the roadside. Estimation was made at a specific hour when the noise level reaches to the maximum within each time zone throughout a day; that is, morning, daytime, evening, and nighttime. Table 17.14 shows the predetermined time zones of a day.

Table 17.14 Time Zones

Classification of Time	Time Zone
Morning	6:00 to 8:00
Daytime	8:00 to 19:00
Evening	19:00 to 22:00
Nighttime	22:00 to 6:00

- Estimation equation

  An estimation equation proposed by the Japan Acoustics Society was utilized in estimating the road traffic noise.

- Traffic condition

  The daily traffic volume, hourly traffic volume, and mean vehicle speed used in the estimation are the same as those which were predetermined for estimating of the air pollution.

b. Road construction noise

Road construction noise was estimated at 1.2 meters above the ground along the boundaries of the construction site.

- Equation used

  A theoretical propagation equation for the point sound source in semi-free space was used for the estimation.

- Estimation conditions

  • Location of sound source

    Location of the sound source was set at 5.0 meters away from the road side, in consideration of the range of construction at each site and the revolving radius of the construction machines.

  • Power level of the noise source: refer to Appendix 17.4(3)(c).

3) Results of Estimation

a. Road traffic noise

Table 17.15 shows the estimated road traffic noise.

Table 17.15 Estimated Road Traffic Noise

Name of Road	Location No.	Estimated Noise (dB(A))			
		Morning 7:00	Daytime 17:00	Evening 19:00	Nighttime 22:00
Ohio	1	64	64	65	57
Gerezani	2	65	66	66	59
Morocco	3	65	66	66	59
Chang' ombe	4	66	66	66	58
New Bagamoyo	5	62	62	62	54
Uhuru	6	67	68	68	60
Kilwa	7	65	65	65	58

b. Road construction noise

Table 17.16 shows the estimated road construction noise.

Table 17.16 Estimated Road Construction Noise

Type of Work	Job Description		Construction Equipment (standard)	Estimated Noise (dB(A))
Earth work	Pavement breaking		Concrete crusher	70
	Excavating		Back hoe (0.6 m^3) Dump truck (11 ton)	80
	Ground leveling		Bulldozer (7 ton) Dump truck (11 ton)	80
Paving work	Roadbed preparation		Bulldozer (7 ton) Macadam roller (10 to 12 ton)	76
	Paving	Asphalt spreading	Asphalt finisher (4.5 m) Dump truck (11 ton)	80
		Roll finishing	Macadam roller (10 to 12 ton) Tire roller (8 to 20 ton)	76

(2) Assessment

1) Environmental Preservation Target

a. Road traffic noise

Environmental quality standards and regulation standards on noise have been established in developed countries including Japan, the United States and European nations as well as by international organizations such as WHO.

Referring to the environmental quality standards in developed countries and in consideration of the present acoustic condition in Dar es Salaam, the environmental preservation target on noise have been determined as below.

Table 17.17 Environmental Preservation Target on Road Traffic Noise

Unit: dB(A)

Time Zone / Area Classification	Daytime	Morning and Evening	Nighttime
	8:00 to 19:00	6:00 to 8:00 19:00 to 22:00	22:00 to 6:00
Area facing a road with two or more lanes	Less than 70	Less than 70	Less than 60

b. Road construction noise

Referring to Japanese regulation standards entitled "Noise Regulation Law", the environmental preservation target for the noise level is below 85 dB(A) along the boundary of the site.

2) Results of Assessment

a. Road traffic noise

The traffic noise at all locations was estimated to be less than 68 dB(A) during the time zones in the morning, daytime and evening, and less than 60 dB(A) during the time zone at night. Comparing the estimated amounts with the environmental preservation target, it is revealed that they would meet the targets (in the morning, daytime, and evening of less than 70 dB(A) and at night of less than 60 dB(A)) Accordingly, the possible impacts of the traffic noise to the residents along the priority roads would be minimal.

Nevertheless, the road traffic noise might possibly bring about a higher noise level in the roadside areas. To keep up with the current living conditions of the priority roads, it is imperative to take necessary measures.

Such measures should include those for establishing legislation concerning environmental quality standards as well as regulation standards on noise for realizing the planned development of land-use in the areas along the trunk roads, and for securing sufficient road space in which appropriate facility equipment be installed.

Additionally, in view of insufficient data concerning noise, it would also be required to conduct noise measurements which could be referred to when needed.

b. Road construction noise

As the estimated road construction noise at each construction site is less than 80 dB(A), it meets the environmental preservation target of less than 85 dB(A). Accordingly the possible impact of the construction noise on the living environment of the residents along the roads would be minimal in the project implementation.

17.4.5 Vibration

(1) Estimation

1) General

As the traffic of motor vehicles increases, the vibrations from it might affect the residents along the roads. Also, the vibrations generated by the road construction equipment will adversely affect the residents.

Traffic vibrations and construction vibrations during project implementation have been studied based on a theoretical equation with the considered factors being listed as follows:

- Items considered

Road traffic vibration	:	highest value of 80% range of vibration level (L_{10})

Road construction vibration: vibration level (mean of the maximum values)

- Years and road width considered

  Same as in the estimation for noise

2) Method of Estimation (see Appendix 17.5)

a. Road traffic vibration

The road traffic vibration is estimated at the ground level along the side of the priority roads. At the specific hour the vibration level reaches the maximum within a time zone, either at daytime or at nighttime. Table 17.18 shows the predetermined time zone in one day.

Table 17.18 Time Zone Predetermined

Classification	Time zone
Daytime	8:00 to 17:00
Nighttime	17:00 to 8:00

- Estimation equation

  An equation proposed by the Public Works Research Institute of the Ministry of Construction of Japan was utilized to estimate the road traffic vibration.

- Traffic condition: Same as in the estimation of noise

b. Road construction vibration

Road construction vibration was estimated along the boundary of the construction site, based on the following:

- Equation used

  A distance attenuation equation for an oscillating wave was employed for the estimation.

- Estimation conditions

  • Vibration level at the observation point: refer to Appendix 17.5(3)(c).

In making the estimation, the energy dispersion from the diffusion of vibration from the source as well as attenuation from friction of the soil in the ground were considered.

3) Results of Estimation

a. Road traffic vibration

Table 17.19 shows the estimated results of road traffic vibration along the roadside.

Table 17.19 Estimated Road Traffic Vibration

Name of Road	Location No.	Estimated Vibration (dB)	
		Daytime (17:00)	Nighttime (19:00)
Ohio	1	53	53
Gerezani	2	58	58
Morocco	3	60	60
Chang' ombe	4	56	57
New Bagamoyo	5	55	55
Uhuru	6	58	58
Kilwa	7	56	56

b. Road construction vibration

Table 17.20 shows the estimated results of road construction vibration at the boundaries of the construction sites.

Table 17.20 Estimated Road Construction Vibration

Type of Work	Job Description		Construction Equipment (standard)	Estimated Noise (dB(A))
Earth work	Pavement breaking		Concrete crusher	53
	Excavating		Back hoe (0.6 m^3) Dump truck (11 ton)	60
	Ground leveling		Bulldozer (7 ton) Dump truck (11 ton)	68
Paving work	Roadbed preparation		Bulldozer (7 ton) Macadam roller (10 to 12 ton)	68
	Paving	Asphalt spreading	Asphalt finisher (4.5 m) Dump truck (11 ton)	67
		Roll finishing	Macadam roller (10 to 12 ton) Tire roller (8 to 20 ton)	53

(2) Assessment

1) Environmental Preservation Target

a. Road traffic vibration

The environmental preservation target of the road traffic vibration has been set as "a level that does not bring nuisance to the daily life of most of the residents in the areas," were determined in reference to the road traffic vibration limit based on the Japanese "Vibration Regulation Law" as follows:

Time zone / Area classification	Daytime 8:00 to 19:00	Nighttime 19:00 to 8:00
Residential area	Less than 70	Less than 60

b. Road construction vibration

Referring to the Japanese "Vibration Regulation Law", the environmental preservation target has been set as below 75 dB(A).

2) Results of Assessment

a. Road traffic vibration

Since the estimated road traffic vibration is less than 60 dB both at daytime and at nighttime, this meets the environmental preservation target and, as such the impact of the traffic vibration to the residents along the roads will be minimal.

b. Road construction vibration

The estimated road construction vibration in each phase of the construction is less than 70 dB, which meets the environmental preservation target. Therefore, the impact of the construction vibration to the residents along the roads will be minimal.

17.4.6 Other Considerations

(1) Socio-economic Impacts

1) Traffic Safety

At present, the traffic lanes and the sidewalks are not separated at most of the roads, and pedestrian crossings wave not been established at appropriate places. Worse yet, traffic control facilities such as signals have been not sufficiently installed. As such, traffic safety of pedestrians and passing motor vehicles is not secured. With the implementation of the priority project, the traffic lanes and sidewalks will be separated and traffic control facilities will be installed, safety will be improved.

2) Area Separation

In places where residents have to cross the road such as near the shopping moles located at roadside, the residents sphere of activities might be separated, if the roads widened. However, since pedestrian crossings and overpasses will be built at appropriate places for the convenience of the residents, it is foreseen that area separation will have little impact on the local community.

(2) Physical and Natural Impacts

1) Flora and Fauna

Since the priority roads are not routed through the habitats of rare flora and fauna such as mangroves, construction work would not have any impact. However, if in the future more large-scale road development projects are carried out in and around Dar es Salaam, the impact on the natural resources including mangroves might be expected. Cautious measures should thus be taken to protect natural resources for environmental preservation in consideration with the following:

(i) Mangroves

Mangrove forests are officially recognized as forest reserves, the entry and use of which are regulated by the Forest Ordinance in Tanzania. Clearing of mangroves for road construction would cause the following impacts:

- Decrease in fauna including birds, fish, crustaceans (mangrove crabs and prawns), mollusks (oysters) and reptiles such as snakes.

- Disappearance of flora, mainly mangrove tree species.
- Decrease in fish and prawn catches since mangroves act as a nursery ground for fish and prawns.
- Increase in coastal erosion.
- Increase in salutation on coral reef.

(ii) Coastal forest

Project implementation might have adverse impact on the important coastal forests of Pugu, Pande and Ruve South Forest Reserves such as:

(a) An increase in the harvesting of wood for fuel.

(b) The encroachment of agriculture.

(c) Collection of plants and fruits for medicinal products.

(d) Excavation of sand and stones.

The three forest reserves maintained above are part of about 213 individual coastal forests remaining along the coast of the Indian Ocean. These forests are of international significance due to the presence of various endemic species of plants and animals. It is estimated that about 10% of the plants are endemic.

(iii) Greenery

Greenery in the city involves various functions such as moderating the weather and composing the beauty of the city as well as in forming a comfortable urban environment for the residents. Accordingly, in implementing the priority project, efforts should be made to create a rich greenery along roadside, not only by preserving the existing roadside trees but by planting new trees as well.

Favorable roadside environment might be created by the project implementation, because positive tree planting is proposed along the sidewalks of priority roads and the existing roadside tree would be preserved.

As shown in Figure 17.5, it is anticipated that the improvement of sideworks by widening of Kivukoni Front might cause an impact on the existing trees. However, since a part of the existing trees are to be transplanted during construction stage and additional trees to be planted, the impact to the existing flora should be minimal.

(iv) Extraction of materials

Rocks, pebbles and sand will have to be obtained for the use in paving. Careless excavation of these resources would result in damage to the environment. Selection of excavation sites and method and the follow-up measures to restore the site condition must be made in consideration of the environmental protection.

2) Landscape

In implementing the priority project, preservation of existing trees and planting of additional trees would be done to create greenary along the roadside and the landscape would consequently be enhanced.

In the improvement of Kivukoni Front, creation of richer green would be foreseen. The Landscape along Kivukoni Front would become better than before.

Part of the shoreline would be reclaimed for the purpose of improving the coastline. Even if the landscape along the coast might be changed after reclamation, it would not give any serious impact because of gentle slope of the embankment.

3) Tide and Drift Sand

Part of the foreshore would be reclaimed during construction of sidewalks to improve Kivukoni Front and it is anticipated that this reclamation work might have an effect on the tide and drift sand. Since the reclamation is limited to a strip only about 30 meters wide along the existing foreshore, its impact on the tide and drift sand would be minimal. Also, the present conditions are such that the shoreline is not used as a bathing place. So the impact of the reclamation would be minimal.

In construction at the shore protecting embankment, it will be necessary to carry out a sufficient investigation at the site in advance, and to make the design in such a manner that the shore protection banks will not collapse.

17.5 Mitigation Measures

This Section presents the mitigation measures concerning the possible environmental impacts during the project implementation.

(1) Flood hazard

- Improving the Flow Capacity of Rivers and Channels

  A smooth flow of the rivers and channels in the City has been hindered, particularly where they run across the roads, by accumulated earth, sand and garbage in and around the culverts. If the water overflows during heavy rains, roads and lands would be in danger. By rebuilding the culverts, hindrance to the flow should be removed to restore flow capacity of the rivers and channels from the viewpoint of flood hazard prevention. As the culvert for Kijitonyama River where it crosses New Bagamoyo Rd. and the one for Sinza River at Morocco Road do not have sufficient flow capacities, new or additional culverts should be installed.

- Preventing Erosion by Protecting the Face of Slopes

  During the rainy wheather, earth and sand will wash out from unprotected slopes into rivers and channels and accumulation of earth and sand hinders the flow capacity. For road and open channel construction, appropriate protective measures should be taken to prevent soil erosion of the slopes.

- Regular Maintenance of Drainage Facilities

  The existing drainage facilities along the roads are less functional due to accumulated earth, sand and garbage, leading to flood hazard. It recommended that the government carry out regular inspections and maintenance of these drainage facilities.

(2) Resettlement

- Formulation of Advanced Resettlement Plan

  An appropriate resettlement plan should be formulated in regard to the preservation of socio-economic standards of living for the residents that have to be moved. It is the basic policy of proposed project in dealing with resettlement, as mentioned before.

- Consensus of the Residents

  During the planning stage of resettlement, close communications with the residents to be moved should be kept. Utmost efforts to reach to consensus with them should be made to reduce troubles resulting from resettlement.

- Detailed Plan to Resettle the Residents

  An alignment plan for priority roads has been formed to minimize socio-economic impacts to the affected residents. The basic policy of this should be applied to the detailed plan for resettlement of the residents.

(3) Air Pollution, Noise and Vibration

- Periodic Cleaning of Roads

  The air quality in Dar es Salaam is not well, since earth and sand accumulated on unpaved surface or carriageway of the existing roads flung up as vehicles pass by. Accumulation of earth and sand on the roads is mainly caused by the overflow of muddy water containing sand. This problem should be resolved by paving the roads and by improving the rainwater drainage system. Since complete solution of this problem might need a long time, it is recommended that tentative measures such as spraying water over the roads and periodic cleaning of them be taken.

- Preventing Pollution with Roadside Trees

  Roadside trees are useful to improve air quality as well as to reduce noise in the areas along the roads, though the effects might differ depending upon the type and density of trees. For this reason, planting of the most suitable types of trees along the roadside should be promoted where the heavy traffic is observed (such as at Morocco Rd.) and in residential areas.

- Consideration of Environmental Issues during Road Construction

  The impact of noise and vibration generated by road construction on the residents along the priority roads should be minimal. In construction of bridge or overpass at places where large numbers of residences are located, like Gerezani Rd., it is necessary to employ appropriate construction method. For example, a method requiring the least possible piling work should to be employed to prevent noise and vibration generation.

Since the road construction requires large amount of earth to be laid on the ground, it is anticipated that many trucks will be involved to carry earth and materials. If those trucks are to operate only in daytime, traffic congestion in the City Center would become more serious. For this reason, consideration should be given in splitting and shifting construction hours; for example, introduction of nighttime construction can be made. In doing so, proper routes for the trucks will have to be selected and trucks would not run through residential areas.

(4) Urban Environment and Landscape

Trunk roads play an important role as arteries of the City, creating the framework of the City. Since creation of favorable urban environment is important issue for Dar es Salaam, careful road development must be undertaken.

In the proposed project, wide road space and sidewalks and bicycle lanes have to be provided for the pedestrian safety as much as possible. Also, roadside trees must be preserved and additional tree planting has to be made. By these measures, favorable roadside environment can be created, leading to improved urban environment as well as enhanced landscape for Dar es Salaam.

17.6 Conclusion and Recommendations

17.6.1 Conclusion

Traffic congestion has become a serious problem in the urban area of Dar es Salaam which has reduced the functional efficiency of the city and deteriorated air quality along the roads. With the increasing population, it is predicted that the reduction of the functional efficiency of the city and the worsening of the urban environment resulting from traffic congestion will be aggravated unless the present situation of insufficient social infrastructure is improved.

The Project intends to widen and improve the principle roads in and around the city of Dar es Salaam under the above condition so that it may develop as a city which is comfortable to live in and has a solid infrastructure base. In this sense, the project will play an important role in alleviating traffic congestion, promoting appropriate land-use and creating a livable urban environment.

In this way, the road development project brings many beneficial social, economic and environmental changes to the city as a whole. However, unless care is taken, there is a possibility that the development will adversely affect the social and natural environment

In summary, the environmental impact assessment shows that the impact of the Project on the roadside environment and the surrounding areas will be less than the allowable level for each of the assessed items and it will be possible to maintain the quality of the environment at an appropriate level.

The followings summarize the results of the assessment on each item:

- Elimination of Flood Hazard and Improvement of River and Drainage System

  It was initially anticipated that the drain water from the road surface would increase as a result of road development and have an impact on the safety margin in the flood control of the rivers and channels. However, the result of the estimation shows that the increased drainage from the road surface will not exceed the flow capacity of two rivers (Ubungo River and Msimbazi River) and hence the safety margin in the flood control is guaranteed. Although it was found that on the Kijitonyama River, the Sinza River and the waterway which crosses Gerezani Rd. the flow volume will exceed the existing capacity, the safety margin in the flood control of the river will also be improved as rehabilitation of the culvert to increasing its flow capacity together with the widening of the road which crosses over the river.

At the places where overflow on roads is currently observed due to damaged road surfaces and insufficient drainage arrangements, the overflow on roads will be eliminated after the road surface is improved and drainage devices are installed as a part of the Project.

However, since it is predicted that the flood hazards may arise as urbanization of the city progresses, legislation of land-use control for rivers and sewerage should be established and an appropriate improvement plan for rivers and sewers should be set.

- Mitigation Measures for Resettlement of Residents

In the road development plan of the priority project, the alignment and width of each road has been carefully examined so as to keep the resettlement of the residents necessitated by the road construction to a minimum. This is in view of preserving the existing community structure and life of the residents along the road.

However, it is found that 577 buildings along the planned roads need to be removed before the road construction. Various problems involved in the resettlement of the residents will probably be resolved by taking mitigation measures against social and economic impacts of the resettlement. It is concluded that the mitigation measures should include compensation for resettlement and securing places to move to with necessary consideration being given by the government to the living environment of the place of resettlement.

- Impact of Air Pollution and Mitigation Measures

As explained before, unless the present road network and conditions are improved, it is predicted that the atmospheric environment along the roads will become much worse as the population and the number of motor vehicles increases. After the roads are widened and improved as a result of the road development plan, the atmospheric environment at the places where traffic congestion is currently observed will be improved. Also, at areas along the unpaved roads where the air quality is currently not well due to dust from the roads, the environment will be improved

According to the result of the estimation, the atmospheric environment along the principle roads meets the environmental preservation target (the environmental standards specified by WHO).

However the concentration of exhaust gases from the existing motor vehicles in Dar es Salaam is very high, causing an adverse impact on the atmospheric environment in the city. Necessary preventive measures such as regulating the concentration of motor vehicle exhaust and establishing a periodic inspection system should be taken in the near future.

- Noise and Vibration

  Noise and vibration from motor vehicles, and construction machines both meet the environmental preservation target. Thus, it will be possible to preserve the living environment of the residents along the roads.

17.6.2 Recommendations

It is expected that the population in Dar es Salaam will increase and the urbanization of the city will progress. Unless a proper city development plan is carried out and sufficient social capital is prepared, it is possible that the functions of the city will be paralyzed and its urban environment will become markedly worse, resulting in the disruption of the steady development of the city.

For sound development of the city, it is therefore imperative to improve the traffic system together with roads (or road systems) which play the most important role within the whole system. On the other hand, for improving the roads, it is important to give necessary considerations to the environment of the roadside areas and try to create high quality road from the viewpoint of creating a favorable urban environment in a positive manner.

This Section summarizes the environmental issues which need to be carefully considered when promoting road improvement for the city of Dar es Salaam together with possible measures to deal with all of the applicable issues. Measures to be taken in the future are recommended to ensure that the city of Dar es Salaam will be with the favorable urban environment being created.

- Prevention of Flood Hazards and Improvement of River Flow Safety Margin

  In the city limits of Dar es Salaam, with rapid urbanization in progress, it is likely that flood hazards will arise more frequently due to an increase in non-permeable ground surface area and an increase in low lands which are randomly developed as residential areas. It is therefore necessary in the near future to examine and carry out the following preventive measures.

- Accelerating improvement and conducting regular maintenance of rainwater drainage system

  Although sewerage and drainage system are provided in part of the city of Dar es Salaam, the coverage of the system is still very low and its function is degraded because of insufficient maintenance. Thus, overflow onto roads and flooding occur very frequently. It is necessary to accelerate improvement of the rainwater drainage system and to conduct proper maintenance regularly.

- Accelerating river improvement

  Principle rivers including Sinza, Ubungo and Msimbazi Rivers run through the city limits, but the banks of these rivers are not suitably protected at all and consequently it is observed that earth and sand have been washed out from the collapsed bank in many places and accumulated on the river bed, thereby lowering the flow capacity of the river. This causes an increase in the potential of flood hazard in terms of flood control. It is therefore necessary to accelerate improvement of rivers including bank protection and river bed improvement.

- Regulating and instructing for suitable land-use

  As more and more residences are randomly built in the river basins the potential of flood hazard has increased. It is necessary to carry out measures for suitable land-use by designating flood hazardous areas and regulating construction of residences in these areas more strictly.

- Monitoring the principle rivers and preparing observation instruments

  Because data on water level and flow volume of the principle rivers are not available, present condition of the rivers such as the correlation between the rainfall and the flow volume or flood mechanism of overflowed rivers is unknown. It is necessary to monitor the water level and flow volume of the rivers and to prepare monitored data. It is also necessary to obtain a complete set of monitoring instruments at the same time.

- Examining comprehensive flood control

  To effectively carry out flood control in an urban area, it is necessary to comprehensively deal with the rainwater drainage in the city and the flood prevention of the rivers as one. In the future it will also be necessary to take action such as storing rainwater or letting it permeate through the ground inside the city limits so as to minimize overflowing.

- Smooth Resettlement of the Residents

  • Forming a suitable resettlement plan

  In order to prevent unfavorable social, economic and environmental impacts on the resettlement of the residents along the project roads who are required to move, a suitable resettlement plan must be formed. In forming a plan, it is advisable that discussions be held with the residents to reach a mutual consent.

  In forming the resettlement plan, careful consideration shall be given for funding the resettlement compensation, securing places to move into, and ensuring the living environment of the place of resettlement in order to avoid being involved in troubles with the residents slated to be moved. It is also necessary to allow the residents to have enough time to prepare for moving.

  • Establishing a guideline for resettlement of the residents

  It is possible that resettlement of the residents is necessitated more frequently as more and more social capital is prepared for various purposes. To cope with this problem in a proper manner, it is required to urgently establish a suitable guideline for the resettlement.

- Preservation of Air Quality

  • Establishment of comprehensive legislation and plans for air pollution prevention

  In the United Republic of Tanzania, it is predicted that air pollution will be caused in the principle cities including Dar es Salaam by mobile sources which mainly comprising motor vehicles and by fixed sources such as factories due to increased industrialization. It is therefore recommended to establish legislations, including the following, as soon as possible:

  • Establishing an air pollution control law

  • Establishing an environmental quality standards and a control standards concerning air pollution

  • Establishing a law stipulating the allowable limit of motor vehicle exhaust gases

  • Introducing periodic and compulsory motor vehicle inspection system

  It will also be necessary in principle cities to form air pollution control plans and atmospheric environment management plans from a long-term and comprehensive viewpoint so as to improve air quality and preserve a favorable atmospheric environment.

- Monitoring air quality

  Because data on the concentration of air pollutant in Dar es Salaam is not sufficient, it is necessary to commence the continuous monitoring of air pollution to obtain complete basic information. Since they are shortage of measuring instruments for monitoring, it is also necessary to obtain a complete set of instruments.

- Consideration for preservation of the air quality during the road construction

  As mentioned before, an asphalt plant will be constructed and commenced operation for the purpose of road construction. Therefore, appropriate airborne particle filtration apparatus must be provided to protect air quality.

- Examining measures for atmospheric preservation in view of global environmental protection

  These days, environmental issues attract public attention throughout the world, and considerable efforts such as the reduction of CO_2 emissions to curb global warming are made in many countries. It will be necessary also in Tanzania, particularly in the principle cities, to carry out necessary long-term action to conserve energy, to create a suitable traffic system aiming at reduction and control of the emission of carbon dioxide and to provide motor vehicles with exhaust control devices.

- Establishment of Legislation and Enforcement of Monitoring for Noise and Vibration

  - Establishment of legislation

    In Tanzania, it is necessary to prepare regulations for controlling noise and vibration in the principle cities including Dar es Salaam so that a comfortable urban environment in the city and along the roads can be achieved.

  - Monitoring and preparing data on noise and vibration

    Because data on noise and vibration in the principle cities are rarely available, the present condition is not known. It is therefore necessary to carry out continuous monitoring and to prepare the existing data and material. Since there is a short of monitoring instruments, it is also necessary to obtain a complete set of instruments.

- Flora and Fauna

  Mangrove forests and coastal forests are located within the city limits of Dar es Salaam and these are recognized as forest reserve.

Furthermore, when rock, pebbles and sand are excavated for the purpose of road construction, sufficient consideration must be given to planning (selection of excavation site and method, returning the site to its original condition, if required.), and the natural environment of the site.

When the road development will take place within mangrove forests and coastal forests, it is necessary to carry out sufficient environmental impact assessment and take suitable conservation measures including changing the development plans.

- Establishing an Environmental Policy and Environmental Action Plans

To promote a nation-wide environmental policy in Tanzania, the National Environmental Management Council established "National Conservation Strategy for Sustainable Development (NCSSD)" in January 1994. The Division of Environment of the Ministry of Tourism, National Resources and Environment is now forming "The National Environmental Policy". Under these circumstances, it is very important to establish an explicit "National Environmental Protection Act" and a clearer "Planning Act and Policies" which will allow the public participation in decision-making; accordingly, it is urgently necessary to prepare complete legislations and to establish various environmental policies as well as environmental preservation plans.

CHAPTER 18 IMPLEMENTATION PLAN

Chapter 18 IMPLEMENTATION PLAN

18.1 Executing Agency

The Director of Roads and Aerodromes, Ministry of Works, Communications and Transport is the government agency responsible for the execution of the construction of the project roads.

The required land/house acquisitions and compensations shall be undertaken by the same agency prior to the commencement of the Project.

18.2 Construction Period of Each Project Road

The construction period for each project road was estimated taking into account the work volume, site conditions, weather conditions, right-of-way situation, etc. The roads have been divided into three basic categories, described as follows:

(1) Arterial Roads in the City Center

These consist of the Ohio, Kivukoni, Sokoine, Gerezani and Bandari Roads having a total length of 6.0 km. The estimated construction period for this work is 2 years.

(2) Middle Ring Road

This consists of widening the Morocco, New Kigogo and Chang'ombe Roads and the construction of the Missing Link, all of which total 9.9 km. The estimated construction period for the Middle Ring Road is also 2 years.

(3) Radial Trunk Roads

These consist of the New Bagamoyo Road, Uhuru Road and Kilwa Road with each one to be constructed individually because their locations are scattered. The length of the required work and estimated construction period for each road is as shown below.

- New Bagamoyo Road (4.3 km) : 1.0 year
- Kilwa Road (3.1 km) : 1.0 year
- Uhuru Road (4.8 km) : 1.5 years

18.3 Construction Packages

The above project roads are to be combined into two packages for implementation purposes, taking into consideration the annual project cost required, scale of the work volume, location of project site, land acquisition situation and nature of the Project. The two construction packages are listed below.

Package A:	The Middle Ring Road and New Bagamoyo Road
Package B:	Arterial Roads in the City Center, Kilwa Road and Uhuru Road

18.4 Implementation Schedule

The implementation schedule was set up taking into consideration the construction period estimated above for each project road, annual construction cost, ease of implementation from the viewpoint of land/house acquisition, etc.

The recommended overall construction schedule for each package as follows:

Package A: Widening of the Middle Ring Road and New Bagamoyo Road (total length of 14.2 km)
- 3 years

Package B: Widening of Arterial Roads in the City Center and Kilwa and Uhuru Roads (total length of 13.8 km)
- 2 years

The recommended implementation schedule is presented in Fig. 18.1.

8.5 Investment Program

The investment program of the Project has been made on the basis of the implementation schedule. Table 18.1 shows the tentative investment program for the proposed road projects.

Fig. 18.1: Proposed Implementation Schedule of High Priority Projects

Package No.	Proposed Roads and Bridges To be Improved	Project Length (km)	High Priority projects to be Implemented in the Short-term Plan				
			1st Year	2nd Year	3rd Year	4th Year	5th Year
			1995	1996	1997	1998	1999
Package A:	Widening of The Middle Ring Road and New Bagamoyo Road	14.15					
Package A-1:	Middle Ring Road Widening of the Middle Ring Road consisting of Morocco, New Kigogo and Chang'ombe with construction of Missing Link	9.88					
Package A-2:	New Bagamoyo Road Widening of New Bagamoyo Road from Morocco Road Junction up to Mpakani Road Junction	4.27					
Package B:	Widening of Arterial Roads in the City Center and Kilwa and Uhuru Roads	13.84					
Package B-1:	Arterial Roads in the City Center Widening of Arterial Roads in the City Center consisting of Ohio Street Kivukoni Front, Sokoine Drive, Gerezani and Bandari Roads	5.98					
Package B-2:	Kilwa and Uhuru Roads Widening of Kilwa Road (3.06 km) Widening of Uhuru Roads (4.80 km)	7.86					

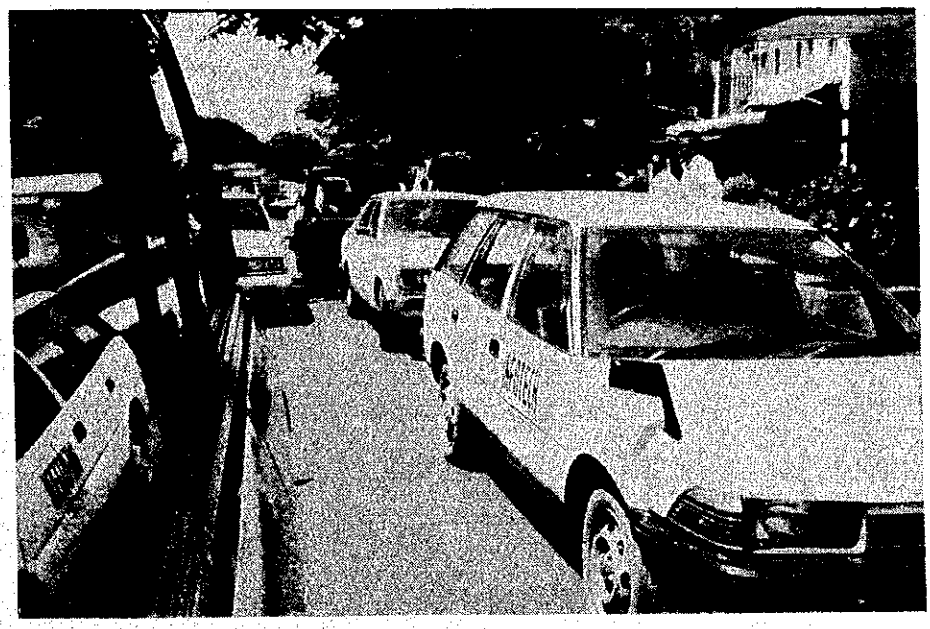
Table18.1 Tentative Investment Programme of High Priority Projects

Unit: Tsh. million

Phase	High Priority Projects	Project Length (km)	High Priority projects to be Implemented in the Short-term Plan										Total	
			1th Year		2th Year		3th Year		4th Year		5th Year			
			1995		1996		1997		1998		1999			
			Const. Cost	House Comp.	Const. Cost	House Comp.	Const. Cost	House Comp.	Const. Cost	House Comp.	Const. Cost	House Comp.	Const. Cost	House Comp.
(1) Construction Cost														
Package A														
Package A-1:	Widening of the Middle Ring Road	9.88												
	- Morocco Road	3.56		151	4,500								4,500	151
	- New Kigogo Road	2.78				130	3,510						3,510	130
	- Missing Link	0.74		20	850								850	20
	- Chang'ombe Road	2.80				5	2,270						2,270	5
Package A-2:	Widening of New Bagamoyo Road	4.27	5,090	15									5,090	15
	Sub Total (a)	14.15	5,090	186	5,350	135	5,780	0	0	0	0	0	16,220	321
Package B														
Package B-1:	Widening of Arterial Roads in the City Center Ohio, Kivukoni, Sokoine, Gerezani and Bandari Roads	5.98						11	3,310		2,350		5,660	11
Package B-2:	Widening of Kilwa and Uhuru Roads	7.86												
	- Kilwa Road	3.06								82	3,510		3,510	82
	- Uhuru Road	4.80						68	2,820				2,820	68
	Sub Total (b)	13.84	0	0	0	0	0	79	6,130	82	5,860	0	11,990	161
	Total Construction Cost (Tsh million): (a)+(b)		5,090	186	5,350	135	5,780	79	6,130	82	5,860	0	28,210	482
(2) Consultant Fee : D/D & S/V = 10 % of Construction cost			510		540		580		610		590		2,820	
(3) Contingneecy for Price Escalation and Pysical Change (10% of Const. cost)			510		540		580		610		590		2,820	
(4) Administration cost of Tanzanian Government (1% of Const. cost)				51		54		58		61		57		282
Total of other project Cost (Tsh million):			1,020	51	1,080	54	1,160	58	1,220	61	1,180	57	5,640	282
Grand Total (Tsh million) : (1)+(2)+(3)			6,110	237	6,430	189	6,940	137	7,350	143	7,040	57	33,850	764
													Grand Total	34,614

Exchange Rate: 1US$ = Tsh. 530.0 = ¥ 100.0 (July, 1994), or Tsh. 1.0 = ¥ 0.188679

CHAPTER 19 EVALUATION ON PROJECT IMPLEMENTATION



CHAPTER 19 EVALUATION ON PROJECT IMPLEMENTATION

19.1 General

19.1.1 Coverage of the Evaluation

The High-Priority Project packages are evaluated in this chapter in terms of the viability of the project implementation. The conventional method of economic evaluation has been applied to measure the magnitude of the economic contribution. The estimated project cost and expectant benefits (mainly, the road users' benefits) were compared using certain indicators to appraise economic feasibility of the project implementation from the viewpoint of the national economy.

It should be noted that the economic evaluation cover the road users' benefits comprising the savings of travel cost and time. Several socio-economic impacts such as effects on urban development and environmental issues (which are not counted in the economic evaluation) are delineated in the Section succeeding to the economic evaluation.

In the final part, the financial viability of project implementation was appraised based on the government budget, especially development accounts. Financing measures to ensure project implementation has also been clarified and recommended.

19.1.2 Procedures of Economic Evaluation

Figure 19.1 shows outline procedures of the economic evaluation.

The economic evaluation begins with the estimation of the economic project cost and the expectant benefit. Economic project cost is obtained from the financial project cost (investment amount) of the proposed package by deducting transfer components such as tax and duties. The economic benefits are the savings of cost and time for road traffic. Details of the benefit calculation are given in Section 19.3. Transfer elements are excluded in the economic benefit calculation, as well.

Subsequent to this, the economic cost and benefits are annualized. To meet the disbursement schedule of the investment, the economic cost figures are prepared annually. The maintenance cost is added to the annual figures to obtain an economic cost stream. In case of the economic benefit, yearly amount is obtained by assuming an annual increase rate.

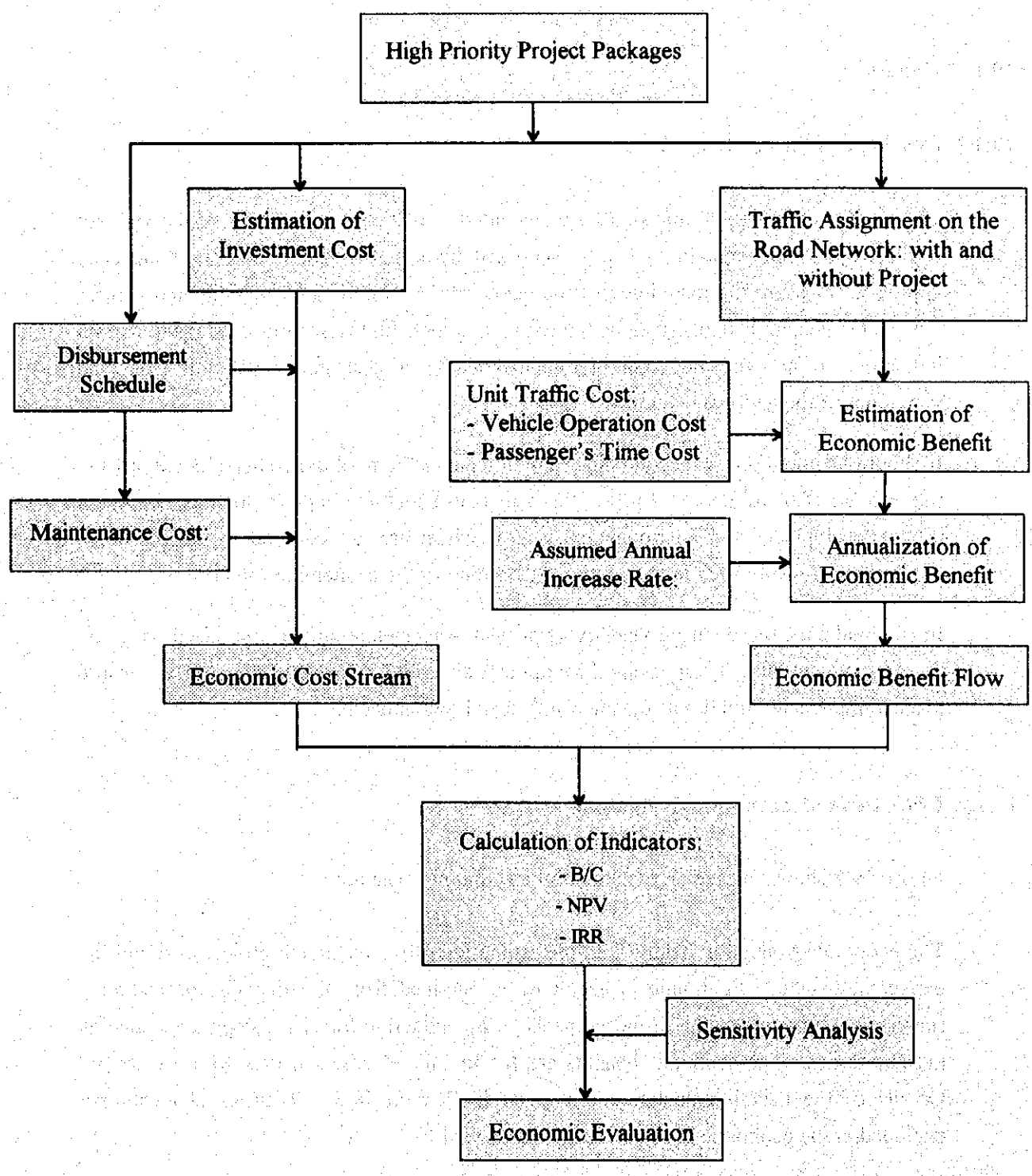


Fig. 19.1 Outline Procedures of Economic Evaluation

The total economic cost (C) and the total economic benefit (B) are calculated afterwards, making use of a discount rate, as shown below.

$$C = \sum_{t=1}^{n} Ct/(1+r)^t$$

$$B = \sum_{t=1}^{n} Bt/(1+r)^t$$

, where
- Ct : Annual economic cost in the year t
- Bt : Annual economic benefit in the year t
- r : Discount rate
- n : Project life in years

The final step is the calculation of the following 3 key indicators for evaluation:

- Benefit - Cost Ratio (B/C)
- Net Present Value (NPV : amount of B-C)
- Internal Rate of Return (IRR : discount rate in case B=C)

If the B/C is over 1.0 or the NPV is higher than 0.0, this means that the social benefit surpasses the required cost and as such the project implementation will be economically feasible. The IRR can be interpreted as a discount rate giving a break-even point between B and C, making both cost stream and benefit flow equal; this shows how fast the investment amount can be recovered. If the IRR is higher than an assumed opportunity cost ratio of capital, contribution to the national economy is well justified in connection with the resources use (=investment), and the project implementation may be deemed as economically feasible.

19.1.3 Case and Preposition in Economic Evaluation

As commented on in Chapter 18, the two High-Priority Project packages have been proposed; namely,-

- Package A : Widening of the Middle Ring Road and New Bagamoyo Road
- Package B : Widening of Arterial Roads in the City Center, and Kilwa and Uhuru Roads

The economic evaluation was conducted for these 2 project packages and their individual components. One more case was added in which Package A and Package B are jointly implemented. As a result, indicators are calculated in the following 8 cases, respectively:

Case 1 : Middle Ring Road and New Bagamoyo Road Improvement
- Case 1.1 : Middle Ring Road Improvement
- Case 1.2 : New Bagamoyo Road Improvement

Case 2 : City Center Arterial Roads and Kilwa/Uhuru Improvement
- Case 2.1 : City Center Arterial Roads Improvement
- Case 2.2 : Kilwa Road Improvement
- Case 2.3 : Uhuru Road Improvement

Case 3 : Joint Road Improvement (Case 1 plus Case 2)

At the same time, the following prepositions were adopted in calculating the evaluation indicators:

(1) Project Life : 15 years after opening of the project. Calculation ends vary according to the different commencements of construction for each case.

(2) Discount Rate : 10% was applied.

(3) Base Year : Set at the commencement of construction for each case for synchronizing the effects measurement between the respective cases.

(4) Price Level : All prices are at constant prices as of July 1994.

(5) Residual Value : 10% of the total investment amount is assumed to place in the last year of the project life (until 15 years after the last disbursement).

19.2 Estimation of Economic Project Cost

19.2.1 Economic Investment Cost

In accordance with the Investment Program in Chapter 18, the estimated financial cost of the High-Priority Project packages was converted into economic investment cost based on the following assumptions:

- Deduction of Transfer Components

  The tax and duty portion were not counted because these are transfer elements in the economy. The deduction ratio of 10% was applied towards the financial project cost.

- Exclusion of Price Escalation

  The price escalation included in the project package, if any, has been deleted. The same applies to the contingency for price escalation (5%) as a part of the financial project cost.

- Exclusion of Land Acquisition Cost

  Cost for land acquisition was not counted as an economic cost, since it is considered to be a transfer element in the economy. Land value will rise in proportion to road construction, and the enhanced amount of the land value is more than the expectant amount of project benefits. Accordingly, compensation cost for house removal was not included in the economic cost.

The economic investment cost for all 8 cases is shown in Appendix 19.1.

19.2.2 Maintenance Cost

It is estimated that the routine maintenance of the constructed roads will annually require Tsh.525 thousand per km for 15 years after the opening. The periodic maintenance cost is estimated to be Tsh. 91 million per km every 5 years after the opening. Both maintenance cost values were converted into an economic cost, after deducting the transfer components (10% of financial cost values). The amounts of the respective economic maintenance costs are shown also in Appendix 19.1.

19.2.3 Cost Stream for Economic Evaluation

Table 19.1 shows the economic cost stream for each of the 8 evaluation cases. Each annual value is the sum of the economic investment cost and economic maintenance cost.

Table 19.1 Cost Stream in 8 Evaluation Cases

Unit : Tsh.million

Year	Case 1	1.1	1.2	Case 2	2.1	2.2	2.3	Case 3
1995	5,314	-	5,314	-	-	-	-	5,314
1996	5,587	5,585	2	-	-	-	-	5,587
1997	6,038	6,036	2	-	-	-	-	6,038
1998	6	4	2	6,400	3,456	-	2,944	6,406
1999	6	4	2	6,122	2,455	3,664	2	6,128
2000	356	4	352	6	3	1	2	362
2001	358	356	2	6	3	1	2	364
2002	463	461	2	6	3	1	2	469
2003	6	4	2	694	298	1	395	700
2004	6	4	2	457	200	255	2	463
2005	356	4	352	6	3	1	2	362
2006	358	356	2	6	3	1	2	364
2007	463	461	2	6	3	1	2	469
2008	6	4	2	694	298	1	395	700
2009	6	4	2	457	200	255	2	463
2010	356	4	-179*)	6	3	1	2	362
2011	356	356	-	6	3	1	2	362
2012	-1,234*)	-703*)	-	6	3	1	2	465
2013	-	-	-	694	298	1	101*)	694
2014	-	-	-	-799*)	-393*)	-111*)	-	-2,493*)
2015	-	-	-	-	-	-	-	-

Remarks: *): Residual value (10% of the total investment amount) is deducted.

19.3 Estimation of Economic Project Benefit

19.3.1 Benefit Calculation

Expectant economic benefits from the project implementation are assumed to be mainly the road users' benefits which are composed of two components: that is, -

- Saving of vehicle operation cost (VOC)
- Saving of passengers' time cost (TC)

First of all, unit VOC and unit TC had to be determined, based on several items of information collected in Tanzania. These unit costs are applied to the results of the traffic assignment.

The economic benefit was obtained as a balance of both VOC and TC between two cases of the traffic assignment; namely, the "without project" case and "with project" case. Due to this procedure, the estimated amount of the economic benefits is closely linked to the traffic assignment volume.

19.3.2 Vehicle Operation Cost

(1) Composition

The vehicle operation cost (VOC) comprises 6 cost components; i.e. fuel consumption, engine oil consumption, tyre/tube wear, repair/maintenance, crew cost and overhead. Amount of VOC varies according to vehicle type, representative vehicle, driving speed and other factors relative to running conditions.

In calculating the VOC, 7 categories of vehicles are considered, as follows:

- Motor Cycle
- Passenger Car
- Light Goods Vehicle
- Medium Goods Vehicle
- Heavy Goods Vehicle
- Bus
- Mini-bus

Table 19.2 Vehicle Characteristics by Category

Item	Motor Cycle	Passenger Car	Light G.V.	Medium G.V.	Heavy G.V.	Bus	Mini-bus
1. Representative Vehicle:	Honda XL-125	Toyota Corolla	Toyota Hilux	Isuzu NKR	Scania	Leyland	Toyota Hilux
2. Vehicle Price: (1,000 Tsh.)							
a. Retail -	2,200	8,035	9,654	26,553	49,853	36,405	9,654
b. Economic -	1,410	4,185	5,028	14,751	47,480	36,405	5,028
3. Fuel Consumption:							
a. Fuel Type	Petrol	Petrol	Petrol	Diesel	Diesel	Diesel	Petrol
b. Consumption Rate (l/1000km)	41.0	83.3	111.1	200.0	200.0	200.0	111.1
c. Fuel Price (Tsh./l)							
- retail	251	251	251	191	191	191	251
- economic	208.5	208.5	208.5	183.8	183.8	183.8	208.5
4. Engine Oil Consumption:							
a. Consumption Rate (l/1000km)	0.5	1.0	1.0	2.0	4.0	4.0	1.0
b. Oil Price (Tsh/l)							
- retail	700	700	700	630	630	630	700
- economic	550	550	550	476	476	476	550
5. Tyre/Tube Wear:							
a. Required No. (Spare included)	2	5	5	7	7	7	5
b. Set Price (Tsh)							
- retail	86,100	117,975	162,075	345,177	1,236,221	1,156,764	162,075
- economic	71,750	97,265	139,600	285,180	992,663	936,103	139,600
c. Average Tyre Life (km)	90,000	80,000	70,000	60,000	40,000	40,000	70,000
6. Vehicle Usage:							
a. Running Distance (km/year)	20,000	25,000	39,000	67,000	80,000	94,000	39,000
b. Operating Hours (hour/year)	2,000	2,200	2,200	2,700	2,900	2,800	2,200
c. Use Limit (years)	6	8	10	12	12	10	10

Remark: Economic price = Retail price less (1) import duty, (2) sales tax and (3) excise duty.

(2) Representative Vehicle and Vehicle Characteristics by Category

The representative vehicle was selected for each category of vehicle type, based primarily on recent market share and the relevantly several studies. After selection of the representative vehicles, information was collected from car dealers, oil companies, tyre distributors, government regulatory offices and so forth. Table 19.2 summarizes the basic data used for the VOC calculation.

(3) Unit VOC in Standard Condition

Using the collected data by vehicle type, the amount of the component cost was calculated to obtain a unit VOC in standard condition. The unit VOC in standard condition is the aggregate of 6 cost components; i.e. (1) fuel cost, (2) engine oil cost, (3) tyre/tube cost, (4) repair/maintenance cost, (5) crew cost, and (6) overhead cost. Table 19.3 shows the resultant unit VOC in standard condition, while the individual cost component figures and the calculation are presented as Appendix 19.2.

Table 19.3 Unit VOC in Standard Condition

Unit : Tsh/km

Cost Component	Motor Cycle	Passenger Car	Light G.V.	Medium G.V.	Heavy G.V.	Bus	Mini-bus
1. Fuel	8.5	17.4	23.2	36.8	36.8	36.8	23.2
2. Engine Oil	0.3	0.6	0.6	1.0	1.9	1.9	0.6
3. Tyre/Tube	0.8	1.2	2.0	4.8	24.8	24.3	2.0
4. Repair/ Maintenance	3.6	8.4	6.4	11.0	29.6	19.4	6.4
5. Crew	-	-	14.2	8.2	9.5	11.7	14.2
6. Overhead	-	-	6.4	15.4	59.3	27.1	7.7
Total (VOC)	13.2	27.6	52.8	77.2	161.9	120.3	54.1

(4) Unit VOC in Response to Speed Level

The basic estimates of the cost components in the VOC have to be adjusted for the travelling speed. Even the distance-related VOC components of tyre/tube cost and repair/maintenance cost were altered by the speed level. Only the crew cost is assumed constant regardless of the speed level. Conversion factors in each cost component to the variant speed level are quoted from: Robley Winfrey, "Economic Analysis for Highways", 1969.

The calculated unit VOC values by speed are shown in Table 19.4. The conversion procedure from the standard condition into the various speed levels are in Appendix 19.3 and 19.4.

Table 19.4 Unit VOC in Response to Speed Level

Unit : Tsh/km

Speed (km)	Motor Cycle	Passenger Car	Light G.V.	Medium G.V.	Heavy G.V.	Bus	Mini-bus
0 -10	14.4	29.8	85.0	164.4	425.7	239.2	86.3
10 -15	13.0	27.6	71.5	137.5	349.8	205.0	75.0
15- 20	12.6	26.3	64.2	122.4	310.0	181.8	65.3
20 - 25	12.3	25.6	58.0	109.5	279.9	165.1	59.0
25 - 30	11.8	25.6	51.2	98.7	253.2	149.8	53.0
30 -35	11.6	24.5	47.9	90.7	237.5	140.0	49.7
35 - 40	11.2	23.2	45.3	86.6	225.1	136.2	46.6
40 - 45	11.2	23.4	43.8	84.2	215.9	132.7	45.5
45- 50	11.4	23.8	43.2	81.0	210.4	131.4	45.2
50 - 55	11.4	24.0	42.1	79.9	205.9	130.2	45.3
55 - 60	11.7	24.5	42.0	79.7	204.2	130.2	45.3
60 - 65	12.1	25.3	42.5	80.1	203.8	132.3	45.5
65 - 70	12.5	26.0	43.9	82.0	204.9	134.5	45.8
70 - 75	13.0	27.6	44.3	84.3	208.3	137.9	46.0
75 - 80	13.6	28.2	46.8	86.4	211.2	143.8	48.1
Over 80	14.7	29.9	49.4	90.9	219.0	151.5	50.7

19.3.3 Passengers' Time Cost

Calculation of the unit TC in this Study is based on the "income approach" method in which the unit value is closely connected to the income level of the road users. The basic data in the calculation are per capita income in the Dar es Salaam Region, average number of passengers and the share of business trip by vehicle type. The individual data, calculation method and resultant unit TC are tabulated in Table 19.5.

Table 19.5 Unit TC Calculation

Item (Data)	Motor Cycle	Passenger Car	Light G.V.	Medium G.V.	Heavy G.V.	Bus	Mini-bus
1. Hourly Per Capita Income, DSM *1 (Tsh/hour)	56.2	56.2	56.2	56.2	56.2	56.2	56.2
2. Average No. of Passengers*2	1.4	2.7	3.5	5.1	4.0	57.3	18.0
3. Share of Business Trip*3	0.15	0.13	0.16	0.13	0.20	0.08	0.08
Unit TC (Tsh/hour) (1.x2.x3.)	11.8	19.7	31.5	37.3	45.0	257.6	80.9

Remarks : (1) *1 : Study Team projection, with income increase during 1994 to 2000. Assuming 290 total working days a year and 6 working hours a day, the working hours per year become 1,740. Annual per capita income is then divided by 1,740 to transform it into a hourly per capita income.

(2) *2 & *3 : Results of traffic survey conducted by the Study Team.

19.3.4 Economic Benefits and the Annualized Flow

The savings of VOC and TC form a major source of economic benefits. By multiplying the unit VOC to the total vehicle running distance and the unit TC to the total vehicle running time in the traffic assignment, the VOC and TC are obtained. The balance between the "without project" case and the "with project" case is the savings of the respective costs which can be interpreted as economic benefits.

Table 19.6 shows the total vehicle running distance and the total vehicle running time in the traffic assignment, while in Appendix 19.5 the detailed data is classified by the speed level and vehicle type. The total economic benefits are tabulated in Table 19.7.

Table 19.6 Total Vehicle Running Distance and Time in the Year 2000

Case	Running Distance (1,000 km)	Running Time (1,000 hour)
Case 1:	1,231,806	39,556
- Case 1.1:	1,196,132	35,800
- Case 1.2:	1,180,775	35,406
Case 2:	1,232,548	37,377
- Case 2.1:	1,184,872	34,562
- Case 2.2:	1,194,087	34,440
- Case 2.3:	1,216,978	36,290
Case 3:	1,287,851	45,029
Basic Case "with" Project	1,150,391	32,117

Source: Results of traffic assignment by the Study Team

Table 19.7 Economic Benefits in the Year 2000

Unit : Tsh.million

Description	Case 1	1.1	1.2	Case 2	2.1	2.2	2.3	Case 3
(1) VOC, without Project	59,124	59,124	59,124	57,920	57,920	57,920	57,920	62,409
(2) VOC, with Project	54,160	56,788	58,175	54,160	55,656	56,022	57,299	54,160
(3) Saving of VOC [(1)-(2)]	4,964	2,336	949	3,760	2,264	1,898	621	8,249
(4) TC, without Project	1,423	1,423	1,423	1,351	1,351	1,351	1,351	1,606
(5) TC, with Project	1,168	1,314	1,278	1,168	1,241	1,241	1,314	1,168
(6) Saving of TC [(4)-(5)]	255	109	145	183	110	110	37	438
Total Benefits [(3)+(6)]	5,219	2,445	1,094	3,943	2,374	2,008	658	8,687

The annual increase rate of economic benefits was assumed to be 6.3% (the value refers to the annual increase rate of registered vehicles, in Chapter 7: Traffic Demand Forecast) until the year 2009, and 3.0% thereafter. The annualized economic project benefit forms a benefit flow throughout the project life (15 years), as shown in Table 19.8.

Table 19.8 Benefit Flow in 8 Evaluation Cases

Unit : Tsh.million

Year	Case 1	1.1	1.2	Case 2	2.1	2.2	2.3	Case 3
1995	-	-	-	-	-	-	-	-
1996	857	-	857	-	-	-	-	857
1997	2,016	1,105	911	-	-	-	-	2,016
1998	4,619	2,164	968	-	-	-	-	4,619
1999	4,910	2,300	1,029	1,982	1,363	-	619	6,892
2000	5,219	2,445	1,094	3,943	2,374	2,008	658	8,687
2001	5,548	2,599	1,163	4,191	2,524	2,135	699	9,234
2002	5,897	2,763	1,236	4,455	2,683	2,269	744	9,816
2003	6,269	2,937	1,314	4,736	2,852	2,412	790	10,434
2004	6,664	3,122	1,397	5,035	3,031	2,564	840	11,092
2005	7,084	3,319	1,485	5,352	3,222	2,725	893	11,791
2006	7,530	3,528	1,579	5,689	3,425	2,897	949	12,533
2007	8,004	3,750	1,678	6,047	3,641	3,080	1,009	13,323
2008	8,509	3,986	1,784	6,428	3,870	3,274	1,073	14,162
2009	9,045	4,237	1,896	6,833	4,114	3,480	1,140	15,055
2010	9,316	4,364	1,952	7,038	4,237	3,584	1,174	15,507
2011	9,596	4,495	-	7,249	4,365	3,692	1,209	15,972
2012	9,883	4,630	-	7,467	4,495	3,803	1,246	16,451
2013	-	-	-	7,690	4,630	3,917	1,283	16,945
2014	-	-	-	7,921	4,769	4,034	-	17,453
2015	-	-	-	-	-	-	-	-

19.4 Economic Evaluation

19.4.1 Economic Evaluation

The calculated 3 key indicators for economic evaluation are tabulated for each of the 8 cases in Table 19.9.

Table 19.9 Indicators in 8 Evaluation Cases

Indicator	Case 1	1.1	1.2	Case 2	2.1	2.2	2.3	Case 3
1. B/C *)	2.7	1.9	1.6	3.1	4.0	5.5	1.9	2.8
2. NPV *) (Tsh. Billion)	27.1	10.3	3.6	26.8	18.5	17.4	3.2	47.3
3. IRR (%)	28.6	21.6	18.9	35.6	44.9	51.5	23.9	29.7

Remark: *) : The discount rate of 10% has been applied in the calculation.

In all cases; the B/C is higher than 1.0, the NPV is more than 0.0, and the IRR is higher than 15%. Specifically, the IRR values in Case 1, Case 2 and Case 3 are almost double the evaluation criteria of 15%. The results of these calculation indicate that the project implementation of all 8 cases can be justified in the economic evaluation as being economically feasible.

Rationale of 15% Used as an IRR Screening Criteria

In interpreting the IRR figure, it is imperative to set up an evaluation criteria which is an opportunity cost ratio of the capital. Usually, a prime interest rate prevailing in the country is adopted as the opportunity cost ratio. During the 1993 to 1994 period, the prevailing interest rate in Tanzania registered at around 30% (commercial bank loan in the short-term: 31%; and lending from the Bank of Tanzania: 27%). However, the prime interest rate contains the portion relating to price escalation due to inflation, which was almost 23% during the same period in Tanzania. Although the government is intending to reduce the inflation rate to almost half, the effects have not been easily perceived. In this circumstance, the price escalation portion inside the prime rate was assumed at 15 to 23%. The remaining 7 to 15% might be used as an opportunity cost ratio of the capital. In this Study, 15% is used (as a maximum opportunity cost ratio) to screen the IRR values.

If comparing the indicator figures for Case 1, Case 1.1 and Case 1.2, a multiplication effect between the component roads are observed in the implementation of Package A. Indicator figures for Case 1 far exceed those for Cases 1.1 and 1.2. This indicates that the

implementation of Package A should not be separated into component roads: i.e.Middle Ring and New Bagamoyo Roads should be improved jointly as a package.

On the other hand, a comparison of the indicators between Case 2 and Cases 2.1, 2.2 and 2.3 suggests possible separate implementation inside Package B. B/C and IRR figures for Cases 2.1 and 2.2 are higher than those of Case 2 which indicates the individual components: the City Center Arterial Roads improvement and the Kilwa Road improvement might be implemented separately. This is because separate implementation will not affect the economic feasibility of Package B.

The indicators also show that the joint implementation of Packages A and B will have a favorable economic feasibility. The B/C and IRR for Case 3 are in between Case 1 and Case 2; however, the NPV is the highest one for this joint implementation.

19.4.2 Sensitivity Analysis

A sensitivity analysis was conducted to check the efficiency of the evaluation procedures as well as to figure out the stability of the project implementation against the possible change in cost and benefit. Conceptual cases of cost and benefit alteration (±10% and ±20%) are assumed, then calculated are the IRR figures in all the combination of the altered cost/benefit.

Table 19.10 lists the IRR figures in the sensitivity test.

Table 19.10 Sensitivity Test Results in 8 Evaluation Cases

IRR figure (unit: %)

Case 1:	Cost				
Benefit	120%	110%	100%	90%	80%
120%	28.61	30.86	33.53	36.65	40.48
110%	26.48	28.61	31.08	34.05	37.63
100%	24.28	26.28	28.61	31.35	34.69
90%	21.98	23.86	26.03	28.61	31.70
80%	19.62	21.36	23.37	25.75	28.60

IRR figure (unit: %)

Case 1.1:	Cost				
Benefit	120%	110%	100%	90%	80%
120%	21.64	23.63	25.95	28.73	32.12
110%	19.75	21.63	23.82	26.43	29.59
100%	17.80	19.58	21.63	24.06	27.01
90%	15.77	17.44	19.38	21.63	24.36
80%	13.67	15.21	16.99	19.11	21.63

IRR figure (unit: %)

Case 1.2:	Cost				
Benefit	120%	110%	100%	90%	80%
120%	18.92	20.75	22.89	25.42	28.48
110%	17.16	18.91	20.93	23.31	26.19
100%	15.36	17.05	18.91	21.14	23.83
90%	13.48	15.01	16.81	18.91	21.42
80%	11.48	12.93	14.62	16.57	18.90

IRR figure (unit: %)

Case 2:	Cost				
Benefit	120%	110%	100%	90%	80%
120%	35.56	38.60	42.10	46.39	50.02
110%	32.78	35.57	38.89	42.88	47.69
100%	29.94	32.53	35.56	39.26	43.77
90%	27.04	29.42	32.22	35.56	39.72
80%	24.04	26.23	28.79	31.84	35.55

IRR figure (unit: %)

Case 2.1:	Cost				
Benefit	120%	110%	100%	90%	80%
120%	44.93	48.61	50.00	51.45	52.94
110%	41.42	44.95	49.02	50.45	51.91
100%	38.00	41.08	44.93	49.47	50.91
90%	34.44	37.34	40.75	44.93	49.92
80%	30.83	33.48	36.56	40.30	44.91

IRR figure (unit: %)

Case 2.2:	Cost				
Benefit	120%	110%	100%	90%	80%
120%	51.52	52.54	53.51	55.00	56.56
110%	50.99	51.51	52.56	53.61	55.13
100%	50.03	50.86	51.51	52.89	53.68
90%	46.90	50.01	50.72	51.50	52.98
80%	41.92	45.83	49.87	50.69	51.49

IRR figure (unit: %)

Case 2.3:	Cost				
Benefit	120%	110%	100%	90%	80%
120%	23.89	26.16	28.78	31.94	35.74
110%	21.77	23.89	26.37	29.31	32.88
100%	19.58	21.57	23.88	26.63	29.94
90%	17.29	19.16	21.33	23.87	26.96
80%	14.88	16.63	18.67	21.02	23.86

IRR figure (unit: %)

Case 3:	Cost				
Benefit	120%	110%	100%	90%	80%
120%	29.74	32.07	34.77	38.03	41.96
110%	27.56	29.74	32.30	35.31	39.09
100%	25.28	27.36	29.74	32.57	35.98
90%	22.95	24.86	27.12	29.74	32.90
80%	20.53	22.31	24.37	26.81	29.74

The evaluation procedures prove positive because no extraordinary IRR figures appear in the sensitivity test.

With regard to implementation stability, all the IRR figures are more than 15% of the screening criteria, except for 5 cases explained below. This means that the project implementation in 8 cases is almost sound regardless of the possible cost/benefit alteration. It should be noted that the basic three cases: Case 1, Case 2 and Case 3 will have no problematic area in their implementation, because all the IRR figures are more than 15% when cost/benefit has been altered by up to ±20%. Only the figures in the

package component show some unstable situations for the implementation. The viability of the project implementation is therefore proved, as a whole.

For the exceptional 5 cases, the following points should be noted:

(1) The IRR figures lower than 15% are found in Case 1.1 (cost 20% up - benefit 20% down), Case 1.2 (cost 20% up - benefit 20% down, and benefit 10% down; and cost 10% up - benefit 20% down) and Case 2.3 (cost 20% up - benefit 20% down).

(2) The cost increase by 20% is not considerable other than for a design change to upgrade the road functions. The contingency (including both price escalation and physical change) has been set at 10% in the Investment Programme, within which at most a 10% cost increase is probable. For this reason, the above 4 cases of cost 20% up can be dropped out in consideration.

(3) The benefit of 20% down will only occur where the traffic volume is decreased by 20%. The implementation of this questionable condition - Case 1.2 (Cost 10% up - benefit 20% down) will thus be depending upon the future traffic volume but this is not too likely in view of the past trends of traffic growth.

19.4.3 Conclusion

It is concluded that the implementation of Packages A and B are both economically feasible having high values of evaluation indicators. The sensitivity analysis results prove the viability of the implementation of Packages A and B.

Considering the proved economic feasibility and implementation viability, Packages A and B should be implemented on a "high-priority" basis as a part of the nationwide road development program. The priority order would be : Package A, first; and Package B, in the next. Higher benefits to recover the investment cost might be expected in the implementation of Package B, as indicated in the economic feasibility. It is, however, judged that Package A implementation be placed first in order, in consideration of the importance of involved roads' functions; especially of the Middle Ring Road as it constitutes the basic frame of the urban trunk road network for Dar es Salaam.

Additionally, a number of commercial/business facilities are located within the right-of-way proposed in Package B, compared to Package A in which such buildings as to be demolished during the construction stage are nil. To the commercial/business proprietors, appropriate arrangements would have to be made either by offering alternate place to keep their business activities prosperous, or in the form of compensation for their business being hindered in addition to physical compensation to the buildings. In concluding such an agreement, a much longer time might be required for Package B. From these considerations, the first priority for implementation be placed on Package A.

19.5 Other Socio-economic Effects

With the implementation of the High-Priority Project packages, road capacity of the trunk road network will be enlarged and appropriate detour routes for through-traffic in the City Center will be provided. Traffic congestion on the trunk road network will be eased and concentration of traffic in the City Center will be reduced. As a result, the efficiency of urban traffic in and around Dar es Salaan will be improved. In addition, inter-area traffic will be moving better between the respective trip ends, leading to reduction in time-distance with each other's area being connected more closely.

Several positive effects will be brought about for the area, the community and the residents by the project implementation. Road users' direct benefits have already been counted in the economic evaluation, in the form of savings of travel cost and time. Foreseeable socio-economic effects other than the direct benefits are pointed out hereunder.

(1) Contribution to the Non-motorized Transport Users

The High-Priority Project packages will provide sufficient spaces for pedestrian walkways and cycle tracks on both sides. A road design with this kind of concern will benefit pedestrians/cyclists/cart users, which is not always the case the existing road facilities are providing.

(2) Improvement of Accessibility to Public Transport Services

Bus routes will cover all the trunk roads in accordance with the enlarged capacity of the roads, where the dedicated bus lanes are to be set up. Bus terminals will be transferred or newly established along the Middle Ring Road, while bus stations will be located at every important intersection with the radial trunk roads for transfer passengers. Bus stops will be placed at suitable intervals on every trunk road for the convenience and access for passengers and residents along the roads. With these arrangements, the level of public transport services will be upgraded as a whole. This kind of improvement will facilitate the potential users to take advantage of the improved public transport services. Thus, the accessibility to public transport services will greatly be improved.

(3) Enhancement of Daily Life of the Residents

Accessibility to public facilities such as hospitals, police stations and schools as well as various government offices will be improved. Public services will become more efficient with the improved access to the potential benefits.

(4) Raising-up of Economic Activity Level

An efficient urban traffic ensures smooth distribution of goods. Raw materials, manufactured products, imported materials/machines and goods for export will all be transported more smoothly. Agricultural produce can be brought into the City for consumption, while agricultural inputs such as fertilizers and seeds be more rapidly sent out to the areas demanding them. Moreover, the manufacturing sector and commercial services will be benefitive to the efficient distribution of goods. As a result, the level of economic activities will rise in different sectors.

(5) Promotion of Planned Urban Development

The High-Priority Project packages will provide the basic frame to allow the urban transport network to meet the demand of future urban development. Intensive land use will be promoted so as to disperse the City Center functions to suburban areas along the Middle Ring Road. Also, inter-area connections among the strategic population clusters having different land uses will be promoted. For example, residential areas will be connected more closely to industrial areas, to commercial centers and to various service facilities. The potential suburban development can be accelerated with the planned location of subcenters that will connect with each other and to the City Center proper. In one way, haphazard urban sprawl might be prevented with the provision of a trunk road network which will embody a suitable disposition of facilities with different functions. As such, the planned urban development will be promoted more functionally.

(6) Improvement of Roadside Environment

As traffic efficiency is improved, the total travel distance will be decreased and this leads to a savings of fuel oil consumption which will cause a decrease of air pollution. According to rough estimates, 11 million liters of oil (equivalent to Tsh. 5.4 million) might be saved in the year 2000, if both project packages are jointly implemented (Appendix 19.6 shows the calculation procedure and results). The saved fuel volume corresponds to almost 10% of the fuel consumption in the "without project" case. As a result, air pollution could be reduced by 10%. Other effects of the roadside environment will be:

- Decrease in dust generation by road pavement
- Improvement of road space by provision of trees, lighting and other ancillary facilities
- Provision of safety measures for pedestrians, cyclists and residents
- Alleviation of inundation of the surrounding flood-prone areas by provision of roadside drainage facilities

19.6 Financing and Budgetary Arrangements

(1) Development Budget and Financing

Government budget of Tanzania was analyzed for Fiscal Year (FY) 1993/94 to FY1996/97 to make sure an actual contribution of foreign assistance to and financing sources of development funds. Table 19.12 summarizes the budget accounts while Table 19.11 shows the estimated project cost of the proposed High-Priority Project packages.

Table 19.11 Project Cost, High-priority Project Packages Proposed

Unit: Tsh. Million

Cost Item	1995	1996	1997	1998	1999	Total
1. Construction	6,110	6,430	6,940	7,350	7,040	33,850
2. Compensation	237	189	137	143	57	764

Table 19.12 Government Budget, FY 93/94 to FY 96/97

Unit: Tsh. million

Budget Item	FY 93/94	FY 94/95	FY 95/96	FY 96/97
1. Total Expenditure	428,750	464,550	476,334	499,174
(1) Recurrent Expenditure	292,827	331,519	356,141	382,788
(2) Development Expenditure	135,923	121,929	107,808	103,058
, of which Foreign Funds	111,036	99,929	87,808	83,058
- Project Loans	26,436	21,251	17,199	17,763
- Project Grant	84,600	78,678	70,609	65,295
2. Sectoral Allocation to Works	34,609	43,460	42,395	43,833
(1) Recurrent Expenditure	5,671	6,397	7,059	8,571
(2) Development Expenditure	28,938	25,961	22,951	21,934
, of which Foreign Funds	23,759	21,382	18,789	17,772
(3) Road Fund	-	11,103	12,385	13,328
(4) Ministerial Allocation to MWCT	31,444	29,167	26,799	26,928
- Recurrent	4,310	4,659	5,141	6,242
- Development	27,314	24,508	21,658	20,685
, of which Foreign Funds	22,740	20,465	17,982	17,010

Source: "Guidelines for the Preparation of the Second Rolling Plan and Forward Budget (1994/95 - 1996/97)", joint publication of the Planning Commission and the Ministry of Finance, December 1993.

- More than 80% of Development Expenditure is financed by external sources (81.7% in FY 93/94, 82.0% in FY 94/95, 81.4% in FY 95/96 and 80.6% in FY 96/97). In regard to the foreign funding, project grants occupy 76 to 80% of total amount with the rest being project loans.
- Allocation to the Works Sector are around 9% of the Total Expenditures, while development accounts show a more heavy proportion of the Works Sector. (In Tanzania, the Works Sector includes road development and rehabilitation). The Works Sector receives a constant 21.3% of the total amount of Development Expenditures. The government policy usually calls for road development and rehabilitation to be given first priority as an infrastructure provision to stimulate the economic activity level.
- From the analysis of expenditure figures, it is revealed that over 81% of development funds allocated to the Works Sector come from external sources. Development allocation to MWCT shows a slightly higher percentage of foreign fund, which is 82%. The figures divided by project loans and grants are not available; however, the general tendency in development accounts can be applied to the Works Sector and to MWCT allocation. By analogy, in the Works Sector/MWCT development financing, almost 65% is in the form of grant-in-aid, 15% by project loans and the remaining 20% by local funds.

If the construction costs for the proposed High-Priority Project packages in 1995 and 1996 (Tsh. 6,110 million and Tsh. 6,430 million) are compared with the MWCT development allocation in FY 95/96 and FY 96/97 (Tsh. 21,658 million and Tsh. 20,685 million), the share of project cost reaches to 28.2% and 31.1%, respectively, of the total development funds allocated to the Ministry. Local funding (only a 20% share as indicated above) probably will not meet the requirements. However, a high proportion of the MWCT development accounts might be justified due to the urgency of project implementation for improving urban traffic as well as by the significance and magnitude of the Dar es Salaam Region in the socio-economic context.

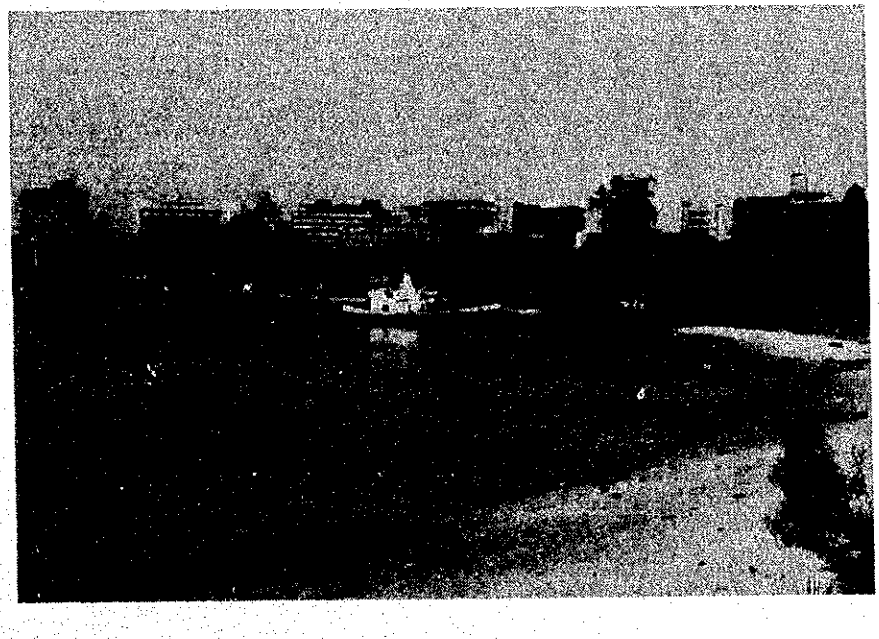
(2) Recommended Action and Financing Measures

The project implementation should be given a "high-priority" rating in the nationwide road development program under MWCT, even if the required cost might occupy a large part of the development allocation to the Ministry. In the economic evaluation, the feasibility as well as viability have already been proved, from the viewpoint of the national economy.

Development allocation to MWCT heavily relies on external sources, especially the grant-in-aid program. In regard to availability of funds and the actual financing possibility, it is recommended the required capital investment cost be financed by means of a grant-in-aid. This financing measure would ensure the effectual project implementation in view of the past experience of road development in the country.

Road maintenance expense is not covered by the above discussion, which shall rather be borne by local funds. Supply measures of the maintenance cost to be required for the High-Priority Project packages should be secured by strengthening the existing Road Fund accounts. The taxation system as well as usage of the Fund should therefore be re-examined.

CHAPTER 20 CONCLUSION AND RECOMMENDATIONS



CHAPTER 20 CONCLUSION AND RECOMMENDATIONS

The following are the conclusion and recommendations related to the project.

20.1 Conclusion

The feasibility study proved that project roads of Packages A and B are technically, economically and environmently feasible having a high economic internal rate of return of 28.6% and 35.6%, respectively.

Therefore, the projects should be realized within the earliest possible time, in the following priority order taking into consideration the functions of the involved roads, especially the Middle Ring Road which constitutes the basic frame of urban trunk road network, and necessary arrangements for land/house acquisitions, resettlement and compensation for commercial/business proprietors located within the proposed right-of-way.

Priority	Proposed Roads
1st	Widening of Middle Ring Road and New Bagamoyo Road (total length of 14.15 km) including:
	- Widening of Morocco, New Kigogo and Chang'ombe Roads from 2 to 4 lanes with construction of Missing Link between New Kigogo and Chang'ombe Road (length of 9.88 km)
	- Widening of New Bagamoyo Road from Morocco Rd. Junction up to Mpakani Rd. Junction to 4 lanes (length of 4.27 km)
2nd	Widening of Arterial Roads in the City Center and Kilwa and Uhuru Roads (total length of 13.84 km) including:
	- Widening of Arterial Roads in the City Center consisting of Ohio Street, Kivukoni Front, Sokoine Drive, Gerezani and Bandari Roads (5.98 km)
	- Widening of Kilwa Road (3.06 km)
	- Widening of Uhuru Road (4.80 km)

Table 20.1 shows the summary of the project features for the above roads.

Table 20.1 Summary of Project Feature

	Project Description	Design Speed (km/hr)	Length (km)	Carriage Way (m)	Pedestrian Footway (m)	Cycle Track (m)	Right-of way (m)
Package A	**Widening of Middle Ring Road and New Bagamoyo Roads**						
A.1	Widening of New Bagamoyo Road from 2 to 4 lane	80	4.30	Dual 2x3.75	2.0~5.0	2.0~3.0	30~50
A.2	Widening of Middle Ring Road with construction of Missing Link		9.88				
	Morocco Road	60	3.58	Dual 2x3.75	2.0~5.0	2.0~3.0	35~50
	New Kigogo Road	60	2.76	Dual 2x3.75	2.0~5.0	2.0~3.0	35~50
	Missing Link	60	0.75	Dual 2x3.75	2.0~3.0	Combined Use	25
	Chang'ombe Road	60	2.79	Dual 2x3.75	2.0~3.0	2.0~3.0	20~25
Package B	**Widening of Arterial Roads in City Center and Kilwa and Uhuru Roads**						
B.1	Widening of Arterial Roads in City Center						
	Ohio Street	40	1.05	Dual 2x3.5	2.0~3.0	Combined Use	20
	Kivukoni Front	40	0.56	Dual 2x3.5	2.0~3.0	Combined Use	20
	Sokoine Drive	40	0.54	Dual 2x3.5	2.0~3.0	Combined Use	20
	Gerezani Street	40	1.42	Dual 2x3.75	2.0~3.0	Combined Use	20
	Bandari Road	40	2.15	Dual 2x3.75	2.0~3.0	Combined Use	20
B.2	Widening of Kilwa and Uhuru Roads						
	Kilwa Road	60	3.115 (3.12)	Dual 2x3.75	2.0~5.0	2.0~3.0	35~45
	Uhuru Road	40	4.85	Dual 2x3.75	2.0~5.0	2.0~3.0	25

It is noted the following major benefits and effects are expected to accrue from the implementation of the Project.

(a) Improvement of Traffic Congestion on the Truck Road Network

Due to the high rate of the city's expansion as well as the recent acute increase of traffic demand accompanying the economic recovery in Tanzania, the traffic flow on the city roads has greatly increased and caused serious traffic congestion on the trunk roads which have insufficient traffic capacity due to having only 2 lanes.

The Widening of the Middle Ring Road and other trunck roads from 2 to 4 lanes will solve chronic traffic congestion on the roads in the city. Also, it will improve not only the economic and social activities but also the daily life of the people in the city.

(b) Reduction of Traffic Concentration in the City Center

The concentration of traffic into the City Center has become worse and worse due to shortage of road capacity within the City Center and lack of appropriate detour route for through traffic in the City Center.

The widening of the Middle Ring Road and Arterial Roads in the City Center will reduce the heavy concentration of traffic in the City Center by providing a direct detour route for the through traffic between the residential areas and the industrial and port areas.

(c) Basic Frame of Urban Development

In JICA's Study of Dar es Salaam Road Development Plan, high priority project roads were planned to provide a basic frame for the urban road network with sufficient road spaces for the future traffic demand in the short-term plan. Also, they are to provide a basic frame for the future urban development of Dar es Salalaam sub-urban areas and Kigamboni area for the long-term plan.

(d) Improvement of Public Transport Services and Non-motorized Traffic

It should be pointed that the majority of city dwellers are public and non-motorized transport users in Dar es Salaam; however, there are very few trunk roads where dedicated transport lanes for buses and bicycles/carts are provided.

The high priority projects will provide sufficient pedestrian walkways and cycle tracks on both sides as well as to provide suitable bus stations for changing purposes at every important intersection with the radial trunk roads.

(e) Improvement of Roadside Environment

With the steadily increasing population in Dar es Salaam, it is predicted that reduction of the functional efficiency of the city and worsening of the urban environment resulting from traffic congestion will be aggravated unless the present social infrastructure is improved.

The implementation of the high priority project will bring many beneficial changes for the society, economy and environment as described below.

- Elimination of Flood Hazard

  Overflow of water on the roads to include flooding has been observed in many places in Dar es Salaam due to damaged road surfaces and insufficient drainage conditions. This flooding will be eliminated by improvement of the road pavement and roadside drainage in the course of the project implementation.

- Establishment of Mitigation Measures for Resettlement

  Widening of the priority roads will require the acquisition of approximately 600 buildings along the roads frontage.

  It is concluded that the mitigation measures should include appropriate compensation for resettlement, securing places for persons to move to, and to settle various problems associated with the resettlement.

- Prevention of Air Pollution

  Unless the present road conditions are improved, the air pollution will become much worse due to an increase of the traffic congestion.

  It is concluded that the air pollution can probably be reduced to the level of the international environmental preservation target, since the Project will reduce the traffic congestion on the roads.

- Improvement of Roadside Areas and Reduction of Traffic Accidents

  It is concluded that the roadside environment will be improved by the provision of tree, lighting and other ancillary facilities under the implementation of the Project for the conformity of pedestrians and nearby residents. Furthermore, traffic accidents will be reduced by the provision of safety measures proposed for drivers, pedestrians, cyclists and residents.

20.2 Recommendations

In order to materialize the projects, the Study Team recommends MWCT to take the following actions:

(1) Financing Measures Required

Since the project implementation will greatly enhance the urban traffic in and around Dar es Salaam, financing measures for capital investment are recommended to be obtained by means of foreign aid from the viewpoint of the government budgetary situation and the past experience of road improvement in Dar es Salaam.

It is also recommended that supply measures of the required maintenance cost for the Project should be secured by strengthening of the existing Road Fund account.

(2) Allocation of Local Budget for Acquiring Land/House

It is recommended to allocate the necessary amount of local funds for acquiring the lands and houses which might be necessary for implementation of the Project.

Land and house acquisition should be conducted according to the project implementation schedule as follows:

Year	Schedule of Land/House Acquisition
1st year (1995)	Acquiring land and houses located at the Mpakani Road intersection on New Bagamoyo Road
2nd year (1996)	Acquisition/relocation of land and houses within the ROW along Middle Ring Road
3rd year (1997)	Acquisition/relocation of land and houses within the ROW along the Arterial Roads in the City Center and Uhulu Road
4th year (1998)	Acquisition/relocation of land and houses within the ROW along Kilwa Road

Furthermore, it is recommended that the land required for the road development should be controlled by the government until the actual development takes place.

(3) Forming a Suitable Resettlement Plan

Resettlement of the residents and workers along the project roads will be required before the implementation of the projects is started.

In order to prevent social, economic and environmental impacts of the resettlement on the residents, it is recommended that a suitable resettlement plan should be established paying due attention to the following items:

- Funding the resettlement compensation
- Securing places to move the person to be resettled
- Ensuring the living standards in the places to move into
- Holding discussions with the residents to be resettled to reach a mutual consent.

(4) Improvement of Storm Drainage System

Although storm water drainage system is provided, two areas along Kijitonyama River and Gerezani Creak become inundated due to insufficient capacity of the existing channel and low land lying near the sea level, respectively.

On the other hand, the proposed improvement measures for these two inundated areas in terms of construction cost, construction period, etc. are too large to include as a part of the road construction project.

Therefore, it is recommended that the two inundated areas be incorporated into a river improvement or storm drainage improvement project that should be implemented in parallel with the road construction.

(5) Regulations for River Basin Land-use

Since houses are being randomly built in the river basins, it is recommended to establish proper land-use regulations for river basin and to properly maintain the storm water drainage system for them.

(6) Establishment of Comprehensive Legislation for Air Pollution Prevention

It is predicted that air pollution will worsen in Dar es Salaam motor vehicles and by factories due to accelerating industrialization.

It is therefore recommended to establish national legislation, including air pollution control law and periodic motor vehicle inspection system, as soon as possible.

(7) Confirmation of Actual Location of Proposed Bus Service Facilities

As the proposed roads are now being utilized for major bus service routes, improvement of bus service facilities has been proposed as one of the components of the High Priority Projects.

It is recommended that the actual location of the proposed bus stops, bus bays and bus stations be determined in accordance with the following criteria, after holding discussions with the agencies concerned:

(i) The location of bus bays should avoid, as much as possible, places where the stopping and starting movements of buses are likely to be interfered with by vehicles from other roads.

(ii) The bus stops, bays and stations shall be close to the pedestrian crossing facilities.

(iii) The bus stops, bays and stations shall be placed where sufficient spaces are available within the given ROW.

(8) Development of DRIMP Office as On-the-Job Training Center

Road maintenance contract has been introduced in line with the MWCT's policy for using the private sector to maximize the efficiency of maintenance work in terms of cost, quality and progress. The full extent of contract maintenance, however, will need sufficient transition period due to the lack of resources and maintenance experience of local contractors.

In this regard, the Study Team recommends to develop the Office of DRIMP (Des es Salaam Road Improvement and Maintenance Project) located in Ilala Garden as a maintenance training center for urban roads. The purpose of this will be to provide on-the-job training for the staff of MWCT, DCC and private contractors, not only to meet the above-mentioned requirements of MWCT's policy but also to encourage maintenance on a contract basis.