10.3 Preliminary Cost Estimates

Unit work quantities of each improvement measures were developed on the basis of the above typical cross sections. The unit rates used in the Study were developed using the recent cost data and the bid prices of the projects similar to the roads proposed in this Study.

CHAPTER 11 FORMULATION OF IMPLEMENTATION PLAN AND SELECTION OF HIGH PRIORITY PROJECTS

11.1 General

The implementation plan was established in terms of short, middle and long plans with target years as shown below:

- Short-term Plan (1990 - 1994)
- Middle-term Plan (1995 - 1999)
- Long-term Plan (2000 -)

11.2 Evaluation of Proposed Roads under Category A

(1) Evaluation Criteria for Priority Projects

In order to select the high priority roads to be implemented in the Short-term Plan, the evaluation criteria was stablished taking into consideration the following factors:

- Engineering view points including degree of pavement deterioration, traffic congestion and traffic volume.
- Transport network/socio-economic view points including function of road, existing land-use pattern and future development potential,
- Policy of the government

(2) Ranking and Evaluation of The Proposed Roads

On the basis of above criteria, each road was evaluated applying group ranking method. All roads were classified into three (3) ranking, namely Rank A, Rank B and Rank C, and

the roads filling into Rank A are deemed to have urgency or to be high priority roads.

(3) Package of Roads in Rank A

The roads classified into Rank A were grouped into packages taking into account of the following:

- Road network requirements to ensure better and efficient connection in the regional road network
- Socio-economic requirements to improve the road system in view of the stimulation of the economic activities as well as the minimum requirement of infrastructures.

(4) Evaluation of Packaged Roads

The packaged roads was re-evaluated using same group ranking method. As the result, the packaged roads classified into Rank A were 6 nos. of packages with a total length of 104 km approx. as shown in Table S.11.1. These packaged roads should be implemented in the Short-term Plan.

11.3 Evaluation of Urgent Repair of Pot-holes under Category B

The urgent repair of pot-holes under this category should be implemented in the Short-term Plan in view of urgency and safety of the drivers and vehicles.

11.4 Evaluation of Proposed Maintenance System under Category C

(1) Establishment of New Road Maintenance Depots

For implementing those new maintenance depots, the Study Team recommends firstly to build main depot only taking into consideration the limitted local funds available for operating these depots as well as the shortage of qualified engineers and administrators in DCC.

Other four (4) nos. of site depots should be built at later stage after bringing-up the engineers, technician and administrators.

(2) Procurement of Plant and Equipment

The Study Team recommends to procure firstly such type of equipment as required for daily and routine maintenance works in the Short-term Plan.

Heavy equipment to be used for overlay and reconstruction of pavement should be procured in the Middle-term Plan after the road maintenance system is substantially organized.

(3) Technical Assistance and Training Programme

Technical assistance and training programme should be implemented in the Short-term Plan. The staff training should be done on the job training through construction of packaged roads under Category A so as to enable DCC to carry out proper maintenance after taking over the completed project roads.

11.5 Formulation of Implementation Plan

Implementation plan was formulated in terms of short, middle and long plans taking into consideration the construction cost required, construction period, technical difficulty and significance to the influenced areas from the economic and social view points.

The plan including Short, Middle and Long-term was summarized in Table S.11.2 and Fig. S.11.1. Tentative implementation schedule with cost disbursement schedule was shown in Fig. S.11.2. Summary of Short-term Plan is as shown in Fig. S.11.3 and summarized below:

Summary of Short-term Plan (1990-1994)

Improvement Measures	Quantities	Approx. Costs
Category A: Improvement of Road Structures	103 km	4,000
Category B: Urgent Repair of Pot-holes	205 km	190
Category C: Improvement of Maintenance System	Sum	280
	Total Tsh.	4,470 M.

Table S.10.1 Summary of Improvement Measures by Road (Categories A and B)

Continued

Name of Roads	Total Length	Section of Maintenance level	Categories A: A-1 Overlay	A-2 Reconstruction	A-3 Widening	A-4 Drainage Structures	A-5 Bus Bays Type-A	A-5 Bus Bays Type-B	A-6 Improvement of Intersection Type-A	A-6 Improvement of Intersection Type-B	Categories B: B-1 Urgent Repair of Pot-holles	
	(km)	(km)	(km)	(km)	(km)	(km)	(nos.)	(nos.)	(nos.)	(nos.)	(km)	(nos.)
1. Arterial Roads												
1-1 New bagamoyo												
-Up to Mpakani J.	8.0	2.0	2.0	1.0	3.0	1.2	6	14	–	–	8.0	250
-Beyond Mpakani J.	15.0	3.0	8.0	4.0	–	–	–	–	–	–	15.0	830
1-2 Morocco	3.5	–	3.5	–	–	–	4	8	–	–	3.5	175
1-3 Kinondoni	0.7	0.2	–	0.5	–	–	–	–	–	–	0.7	52
1-4 Morogoro												
-Up to Port Ac. J.	4.8	–	–	–	4.8	–	6	10	–	–	4.8	48
-Beyond Port Ac. J.	4.7	–	4.7	–	–	–	–	–	–	–	4.7	47
1-8 Bandari	2.2	1.0	–	1.2	–	0.3	–	–	–	–	2.2	130
1-9 Kilwa												
-Up to 8.6km	8.6	2.6	5.5	0.5	–	1.0	–	–	–	–	8.6	351
1-10 Uhuru	2.8	–	1.9	–	0.9	–	2	10	1		2.8	140
1-11 Msimbazi	1.6	0.6	1.0	–	–	–	–	–	–	–	1.6	56
1-13 Upanga	1.8	–	–	–	1.8	0.3	–	–	1	–	1.8	18
1-15-1 Nkrumah	0.3	–	0.3	–	–	–	–	–	–	–	0.3	15
1-15-3 Sokoine	0.8	–	–	–	0.8	–	–	–	–	–	0.8	8
1-15-4 Gerezani	1.2	–	1.2	–	–	–	–	–	–	–	1.2	60
1-15-5 Kivukoni	1.0	–	1.0	–	–	–	–	–	–	–	1.0	50
1-15-6 Maktaba	0.9	–	0.9	–	–	–	–	–	–	3	0.9	45
1-15-7 Ohio	1.0	–	1.0	–	–	0.4	–	–	–	–	1.0	50
1-15-8 Ocean	3.2	–	3.2	–	–	–	–	–	–	–	3.2	160
sub-total	62.1km	9.4km	34.2km	7.2km	11.3km	3.2km	18nos.	42nos.	2nos.	5nos.	62.1km	2485nos.

Name of Roads	Total Length	Section of Maintenance level	Categories A: A-1 Overlay	A-2 Reconstruction	A-3 Widening	A-4 Drainage Structures	A-5 Bus Bays Type-A	A-5 Bus Bays Type-B	A-6 Improvement of Intersection Type-A	A-6 Improvement of Intersection Type-B	Categories B: B-1 Urgent Repair of Pot-holles	
	(km)	(km)	(km)	(km)	(km)	(km)	(nos.)	(nos.)	(nos.)	(nos.)	(km)	(sq.m)
2. Collector Roads												
2-1 Old Bagamoyo	8.2	–	2.0	6.2	–	1.8	–	–	–	–	8.2	720
2-2 Haile Sellasie	5.0	–	3.0	2.0	–	–	–	–	–	–	5.0	350
2-3 Toure Drive	5.6	–	5.6	–	–	–	–	–	–	–	5.6	280
2-4 Bongoyo	0.8	–	0.8	–	–	–	–	–	–	–	0.8	40
2-5 Shekilango	3.8	–	2.0	1.8	–	1.9	–	–	–	–	3.8	280
2-6 Kondoa	1.2	–	1.2	–	–	–	–	–	–	–	1.2	60
2-7 Mwinjuma	2.4	–	–	2.4	–	2.4	–	–	–	–	2.4	240
2-8 Makanya	5.0	–	1.5	3.5	–	1.2	–	–	–	–	5.0	425
2-10 Kigogo C-1	2.0	1.0	–	1.0	–	1.0	–	–	–	–	2.0	110
2-13 Old Kigogo	6.8	–	1.0	5.8	–	–	–	–	–	–	6.8	630
2-14 Kagera	2.0	1.0	–	1.0	–	–	–	–	–	–	2.0	110
2-15 Mikumi	1.1	–	–	1.1	–	–	–	–	–	–	1.1	110
2-16 New Kigogo	2.7	1.5	–	1.2	–	–	–	–	–	–	2.7	135
2-17 Chango' mbe	4.6	3.0	1.6	–	–	–	–	–	–	–	4.6	110
2-18 Temeke	1.9	1.9	–	–	–	–	–	–	–	–	1.9	19
2-19 Mbagala I	1.4	0.4	–	1.0	–	–	–	–	–	–	1.4	104
sub-total	54.5km	8.8km	18.7km	27.0km	–	8.3km	–	–	–	–	54.5km	3723nos.
3. Local Roads (Area Roads Proposed by DCC)												
A. Oyster Bay Area	8.1	–	–	8.1	–	–	–	–	–	–	8.1	810
D. Central Area	10.3	–	–	10.3	–	–	–	–	–	–	10.3	1030
E. Kariakoo Area	30.0	–	–	30.0	–	–	–	–	–	–	30.0	3000
F. Chango' mbe Area	14.6	–	–	14.0	–	–	–	–	–	–	14.6	1460
G. Temeke Area	13.9	–	–	13.9	–	–	–	–	–	–	13.9	1360
H. Ilala Area	10.3	–	–	10.3	–	–	–	–	–	–	10.3	1030
I. Other Important Rd.												
-Mwinjuma L-1	1.5	–	–	1.5	–	–	–	–	–	–	1.5	150
sub-total	88.7km	–	–	88.7km	–	–	–	–	–	–	88.7km	8840nos.
Total	205.3km	18.2km	52.9km	122.9km	11.3km	21.9km	18nos.	42nos.	2nos.	3nos.	205.3km	15048nos.

Table S.10.2 Improvement Measures of Road Maintenance System under Category C

Measures	Short term		Medium/Long term	
	Patching	Other Maint.	Maintenance	Total
Establishment of Road Maintenance Depot				
- Main Depot		1No.	-	1
- Sub Depot		-	4Nos	4
Procurement of Maintenance Equipment				
Tipper Truck (7tons)	3	1	5	9
LWB(Long Wheel Base)Truck (7tons)	1	1	2	4
Vib. Roller (2tons)	2	-	2	4
Bitumen Sprayer(200)	2	-	2	4
Water Tanker (6 k.l)	-	2	-	2
Moter Grader (2.8m)	-	1	3	4
Excavator (0.4 cu.m)	-	1	1	2
Road Sweeper (7.9ton)	-	-	2	2
Supervisory Vehicle (pick-up)	2	2	5	9
As. Cutter (5.8Kg)	2	-	2	4
2tons Dumpers	-	2	2	4
Motor Cycle	2	-	-	2
Road Marking Set	-	1	2	3
Compressor	1	-	-	-
Walk Talkies	4	-	-	4
Two Way Radio	2	-	-	2
Procurement of Workshop Equipment				
Double Cabin Pick-up (3.5tons)	-	1	-	1
Tipper Truck (7tons)	-	1	-	1
Welding Machine	-	1	1	2
Generator (8KVA)	-	2	-	2
Compressor (3.5cu.m)	-	1	1	2
Overhead Crane	-	1	-	1
Chain Bluck	-	3	-	3
Fuel Pump	-	3	-	3
Fuel Dispenser	-	1	-	1
Tool Box	-	5	-	5
Motor Cycle	-	2	4	6
Fuel Tank(20Kl)	-	1	-	1
Steel Wheeled Roller (8-10t)	-	-	1	1
Pneumatic Tired Roller (8-10t)	-	-	1	1
Walk Talkies	-	-	2	2
Dump Trucks (10tons)	-	-	5	5
Bulldozer (D7/Ripper)	-	-	1	1
As.Finisher (3.6m)	-	-	1	1
Excavator (2.5 cu.m)	-	-	1	1
Other Tool	-	1	-	1
Technical Assistance and Training				
- Technical Assistance for administration or supervision of maintenance works		1 expert	-	1
- Training for mechanics and operator		1 expert	-	1

Table S.11.1 Ranking of Packaged Roads
(Improvement of Road Structures)

Package No.	Link No.	Name of Roads	Road Length (km)	Total Score	Ave. Score (S)	Ranking of Package Rank A Ave.<S	Rank B S<Ave.
P-1		Morogoro Ext. 1	5.0	75	75	5.0	-
	1-4-1	Up to Port Access	5.0	75			
P-2		New Bagamoyo Group	9.8	165	83	9.8	-
	1-13	Upanga	1.8	85		-	-
	1-1-1	New Bagamoyo up to Mpakani Junc.	8.0	80		-	-
P-3	1-9	Kilwa Road	8.6	60	60	-	8.6
P-4		Oyster Bay Group	27.7	295	59	-	27.7
	Area A.	Oyster Bay Area	8.1	45			
	2-2	Haile Sellasie	5.0	70			
	2-3	Toure Drive	5.6	55			
	2-4	Bongoyo	0.8	55			
	2-1	Old Bagamoyo	8.2	70			
P-5		Mwinjuma Group	16.9	390	65	16.9	-
	Area B.	Mwinjuma	2.4	60			
	I	Mwinjuma L-1	1.5	50			
	1-2	Morocco	3.5	65			
	1-3	Kinondoni	0.7	75			
	2-5	Shekilango	3.8	70			
	2-8	Makanya	5.0	70			
P-6		Kigogo Group	15.8	345	58	-	15.8
	2-1	Old Kigogo	6.8	70			
	2-6	Kondoa	1.2	55			
	2-14	Kagera	2.0	40			
	2-15	Mikumi	1.1	65			
	2-10	Kigogo C-1	2.0	55			
	2-16	New Kigogo	2.7	60			
P-7		Central Group	20.9	565	63	20.9	-
	Area C.	Central Area	10.3	65			
	1-8	Bandari	2.2	75			
	1-15-1	Nkrumah	0.3	65			
	1-15-2	Sokoine	0.8	65			
	1-15-4	Gerezani	1.2	65			
	1-15-5	Kivukoni	1.0	50			
	1-15-6	Maktaba	0.9	65			
	1-15-7	Ohio	1.0	65			
	1-15-8	Ocean	3.2	50			
P-8		Kariakoo Group	31.6	135	68	31.6	-
	Area E.	Kariakoo Area	30.0	70			
	1-11	Msimbazi	1.6	650			
P-9		Chango'mbe Group	19.2	145	73	19.2	-
	Area F.	Chango'mbe Area	14.6	75			
	2-17	Chango'mbe	4.6	70			
P-10		Temeke Group	17.2	145	48	-	17.2
	Area G.	Temeke Area	13.9	35			
	2-18	Temeke	1.9	40			
	2-19	Mbagala I	1.4	70			
P-11		Ilala Group	13.1	60	60	-	13.1
	Area H.	Ilala Area	10.3	50			
	1-10	Uhuru Road	2.8	70			
P-12		Morogoro Ext. 2	4.5	60	60	-	4.5
	1-4-2	Up to TRM 4.5	4.5	60			
P-13		Bagamoyo Road from Mpakani to Wazo Hill	15.0	(70)		(15.0)	-
	Total		205.3km	2,580		103.4km	86.9km

Note: Bagamoyo Road from Mpakani Road junction up to Wazo Hill was deleted from the subject of the Study because of the commitment of Italian Government.

Table S.11.2 Summary of Implemention Plan

Improvement Measures	Quantity	Fund Requirement (Tsh.xMill)
1. Short Term Plan		
Category A : Improvement of Road Structutres		
P-2 Widening of New Bagamoyo Group	9.8	890
- Upanga Road	(1.8)	
- New Bagamoyo up to Mpakani Junction	(8.0)	
P-1 Widening of Morogoro up to Port Access	5.0	810
P-9 Improvement of Chango'mbe Group	19.2	510
- Chango'mbe Area Roads	(14.6)	
- Chango'mbe Road	(4.6)	
P-8 Improvement of Kariakoo Group	31.6	900
- Kariakoo Area Roads	(30.0)	
- Msimbazi Road	(1.6)	
P-5 Improvement of Mwinjuma Group	16.9	450
- Mwinjuma Area Roads	(2.4)	
- Mwinjuma L-1 Road	(1.5)	
- Morocco Road	(3.5)	
- Kinondoni Road	(0.7)	
- Shekilango Road	(3.8)	
- Makanya Road	(5.0)	
P-7 Improvement of Central Group	20.9	440
- Central Area Roads	(10.3)	
- Bandari Street	(2.2)	
- Nkurumah Street	(0.3)	
- Sokoine Drive	(0.8)	
- Gerezani Street	(1.2)	
- Kivukoni Street	(1.0)	
- Maktaba Street	(0.9)	
- Ohio Street	(1.0)	
- Ocean Drive	(3.2)	
Sub-total (A)	103.4 km	4,000
Category B: Urgent Repair of Pot-holes		
U-1 Urgent Repair of Pot-holes Sub-total (B)	205.9 km	190
Category C: Improvement of Maintenance Systems		
M-1 Construction of Main Depot	1 no.	170
M-2 Provision of Equipment (Phase I)	Sum	110
M-3 Technical Assistance/Training	T/A	-
Sub-total (C)		280
Total of Shrot-term Plan (A+B+C)		Tsh.4,470
2. Middle Term Plan		
Category A: Improvement of Road Structures		
P-3 Improvement of Kilwa Road	8.6	120
P-11 Improvement of Ilala Area Roads	13.1	600
- Ilala Area Road	(10.3)	
- Uhuru Road	(2.8)	
P-4 Improvement of Oyster Bay Group	27.7	550
- Oyster Bay Area Roads	(8.1)	
- Haile Sellasie	(5.0)	
- Toure Drive	(5.6)	
- Bongoyo Street	(0.8)	
- Old Bagamoyo Road	(8.1)	
P-6 Improvement of Kigogo Group	15.8	460
- Old Kigogo Road	(6.8)	
- Kondoa Street	(1.2)	
- Kagera Street	(2.0)	
- Mikumi Street	(1.1)	
- Kigogo C-1	(2.0)	
- New Kigogo Road	(2.7)	
P-10 Improvement of Temeke Group	17.2	510
- Temeke Area Roads	(13.9)	
- Temeke Road	(1 9)	
- Mbagala I Road	(1.4)	
P-13 Improv. of Morogoro Beyond Port Access	4.5	60
P-14 Improv. of Central Ring Road (Widning)	5.2	780
Sub-total (A)	110.2 km	3,080
Category C: Improvement of Maintenance Systems		
M-4 Construction of Site Depots	4 nos.	50
M-5 Provision of Equipment (Phase II)	Sum	270
Sub-total (C)		320
Total of Middle-term Plan (A+C)		Tsh. 3,400
3 Long Term Plan		
Category A: Improvement of Road Structures		
P-15 Improvement of Middle Ring Roads	14.3	2,600
P-16 Improv. of 2 Intersections by grade separation		500
Sub-total (A)	14.3 km	3,100
Total of Long-term Plan (A)		Tsh. 3,100

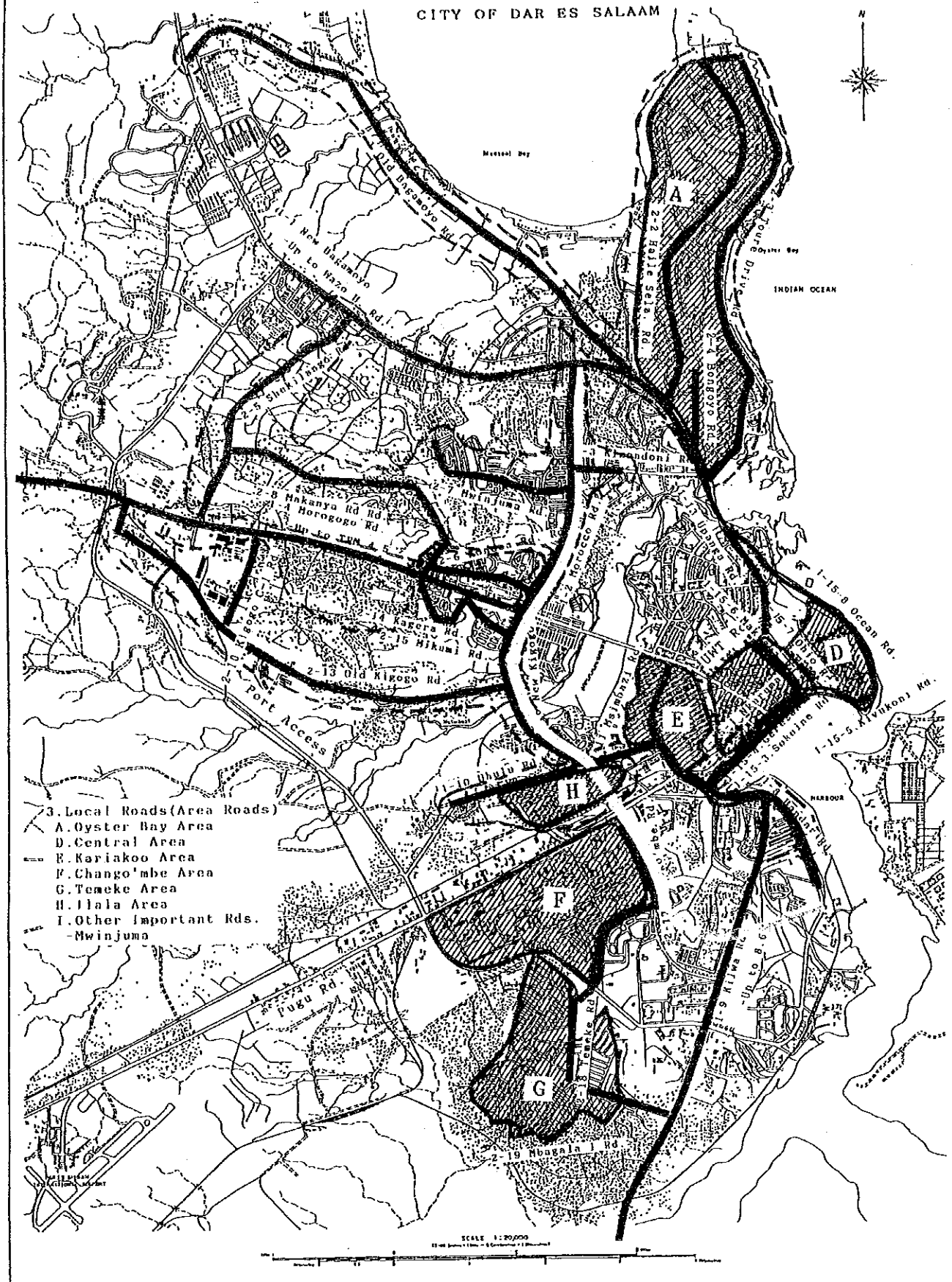


Fig. S-11-1 Summary of Implementation Plan

Short Term

Midium Term

Long Term

Fig. S-11-2 Tentative Implementation Schedule

Improvement Measures	Short-term Plan					Middle-term Plan					Long-term Plan				
	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
1 Category A															
(1) Short-term plan															
P-2 New Bagamoyo (9.8km)		(400)	(490)	(Tsh 890 × 10⁶)											
P-1 Windening of Morogoro Road (5.7km)		(400)	(410)	(810)											
P-8 Central Area Group (20.9 km)		(240)	(200)	(440)											
P-10 Changombe Area Group (19.2 km)		(170)	(340)	(510)											
P-9 Kariakoo Area Group (31.0 km)			(200)	(700)	(900)										
P-6 Mwinjuma Area Group (16.7 km)				(450)	(450)										
(2) Middle-term Plan															
P-3 Kilwa Road (8.6km)						(120)									
P-12 Ilala Area Group (10.3 km)						(400)	(200)	(600)							
P-5 Oyster Bay Group (27.7 km)						(350)	(200)	(550)							
P-7 Kigogo Area Group (15.8 km)							(460)								
P-11 Temeke Area Group (17.2 km)								(510)							
P-13 Morogoro Beyond Port Access (4.5km)								(60)	(780)						
P-14 Improvement of Central Ring Road (5.2km)							(460)	(320)							
(3) Long-term Plan															
P-15 Improvement of Middel Ring Rord (14.3km)											(700)	(700)	(700)	(500)	(2600)
P-16 Improvement of 2 Intersections by grade separation											(200)	(200)	(100)	(500)	
Required Funds	1.210	1.640	1.150	–	–	1.330	860	890	–	–	900	900	800	500	–
2 Category B															
U-1 Urgent Repair of Pot-holes (205km)	(190)	(Tsh 190 × 10⁶)													
Required Funds	190	–	–	–	–	–	–	–	–	–	–	–	–	–	–
3 Category C															
M-1 Construction of New Maintenance Depots		Phase 1; Main Depot (170)				Phase 2; 4Nos of Site Depots (50)									
M-2 Provision of Road Maintenance Equipment		Phase 1; Equipment for Daily Maintenace (110)					Phase 2; Equipment for Overlay/Reconstruction (270)								
M-3 Technical Assistance/Training			Technical Assistance On the job raining												
Required Funds	170	110	–	–	–	50	270	–	–	–	–	–	–	–	–
Total Amount of Fund Required Unit	1.570	1.750	1.150	–	–	1.380	1.130	890	–	–	900	900	800	500	–
	Ts 4.470 × 10⁶					Tsh 3.400 × 10³					Tsh 3.100 × 10⁶				

(Unit; Tsh × 10⁶)

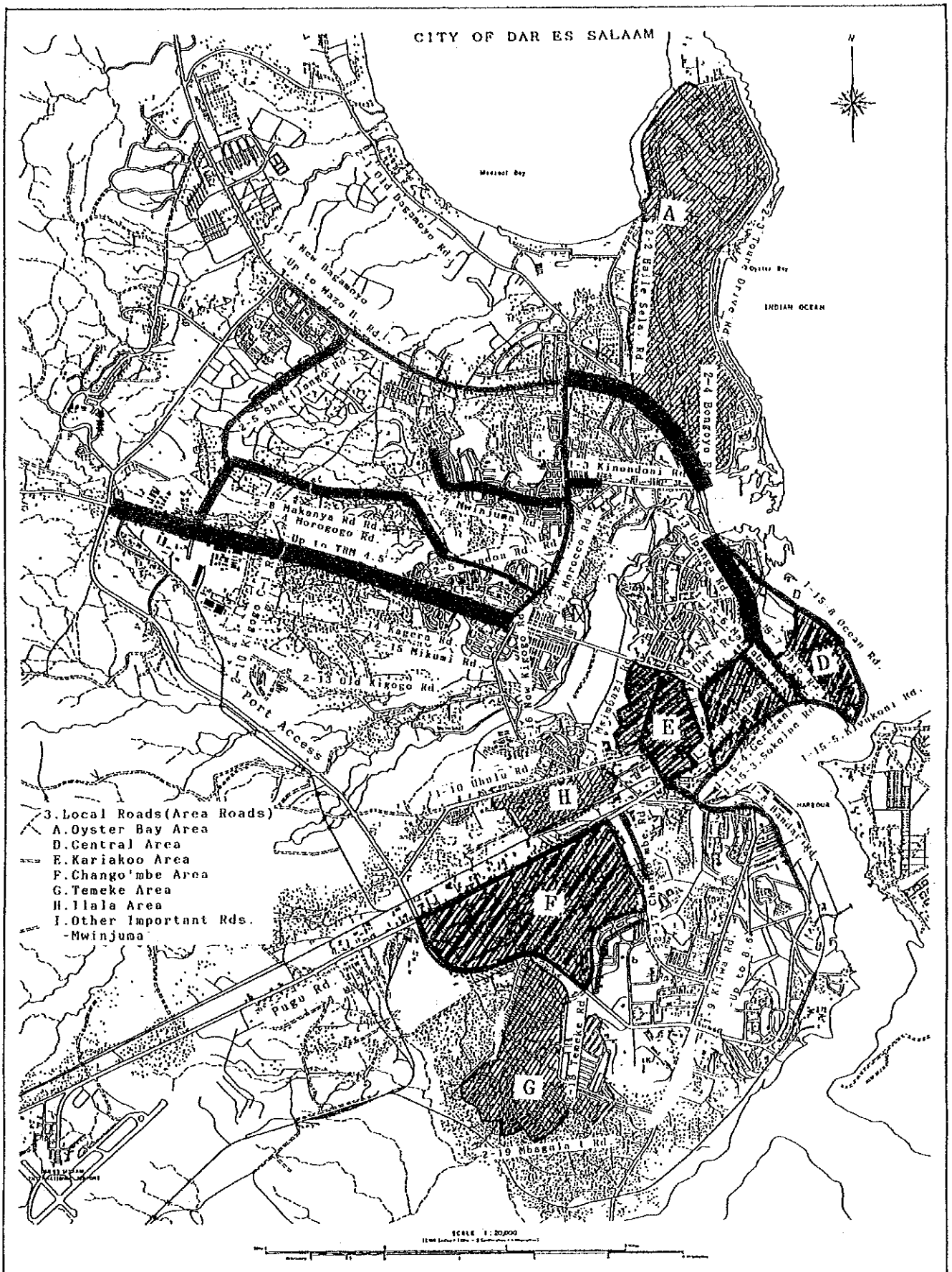


Fig. S-11-3 High Priority Projects in Short Term Plan (1990-1994)

CHAPTER 12 PRELIMINARY ENGINEERING DESIGN FOR HIGH PRIORITY PROJECTS

12.1 General

Supplemental field surveys was carried out along the high priority project roads selected in the previous chapter. On the basis of the data and information obtained through the supplementary field surveys, the preliminary engineering design was conducted using the existing topographical maps with a scale of 1/2,500.

12.2 Supplementary Field Surveys

The supplementary surveys conducted by the Study Team are the following:

- Topographical survey including preparation of Maps with a scale of 1/500 for junctions, cross section survey and right-of-way survey
- Utilities survey including water mains, telephone cables, electric wire and posts, and sewerage and sanitary drainage
- Traffic survey on area roads of Chang'ombe, Kariakoo, Mwinjuma and Central Areas
- Intersection traffic movement survey at major intersections of Morogoro, Upanga and New Bagamoyo Roads
- Pavement structural component survey including 24 nos. of sampling and laboratory tests
- Road inventory and drainage survey on all of the high priority project roads selected with a total length of 104.1 km

12.3 Preliminary Engineering Design

(1) Design Criteria

The function of proposed Morogoro and New Bagamoyo Roads are expected to be arterial roads focussing on the Central Area of the City with a high design standards. Design criteria to be applied for the project roads should be a high standard to meet the requirement of function as shown in Table S.12.1.

(2) Project Length by Improvement Measures

The project length by improvement measures was reviewed on the basis of field survey and the results are presented in Fig. S.12.1. through S.12.3 with minor correction of total length from 103.4 km to 104.1 km.

(3) Geometric Design

Since the Project aims at improvement of the existing roads with overlay, reconstruction and widening, no major change of alignments were proposed in the Project. Typical cross sections to be applied for the project were presented in Fig. S.12.4

(4) Intersection Design

The analysis on traffic movement was carried out for the major junctions on the proposed roads. As the result, it was concluded that signal controlled facilities should be provided at the following junctions:

- 3 junctions on Morogoro Road
- 2 junctions on Upanga Road
- 5 junctions on New Bagamoyo Road

(5) Bus Bay and On/Off Loading Bay for Goods at Manzese

Bus service plays an important role in the public transport system in Dar es Salaam. As for Morogoro Road, special type of bus bay and on/ off loading bay were considered at Manzese area taking into account the large numbers of people as well as goods and products brought to the nearby market.

(6) Pedestrian Bridge

The proposed pedestrian bridge across Morogoro at Manzese is the first pedestrian bridge in Dar es Salaam. The main features of the bridge are as below:

- Type of Bridge : Prestressed Hollow Slab Concrete (PC)
- Bridge Length : 48 m
- Span Arrangement: 10.1 x 2@12.25 x 10.1
- Bridge Width : 5 m

Table S.12.1 Design Criteria for Widening Sections

Design	Morogoro Road	Upanga Road	New Bagamoyo Road
Design Speed	80 km/hr	60 km/hr	80 km/hr
Minimum Radius	300 m	150 m	300 m
Maximum Gradient	5 %	6 %	5 %
Pavement Width	4 lanes (2x2x3.75m)	4 lanes (2x2x3.50m)	4 lanes (2x2x3.75m)
Shoulder	1.50-2.50m	0.50 m	1.50-2.50m
Median Strip	7.50 m	0.50 m	7.50-10.0m
Sidewalk	2x3.50 m	2x3.00 m	2x3.50 m
Minimum Sigth Distance	115 m	75 m	115 m

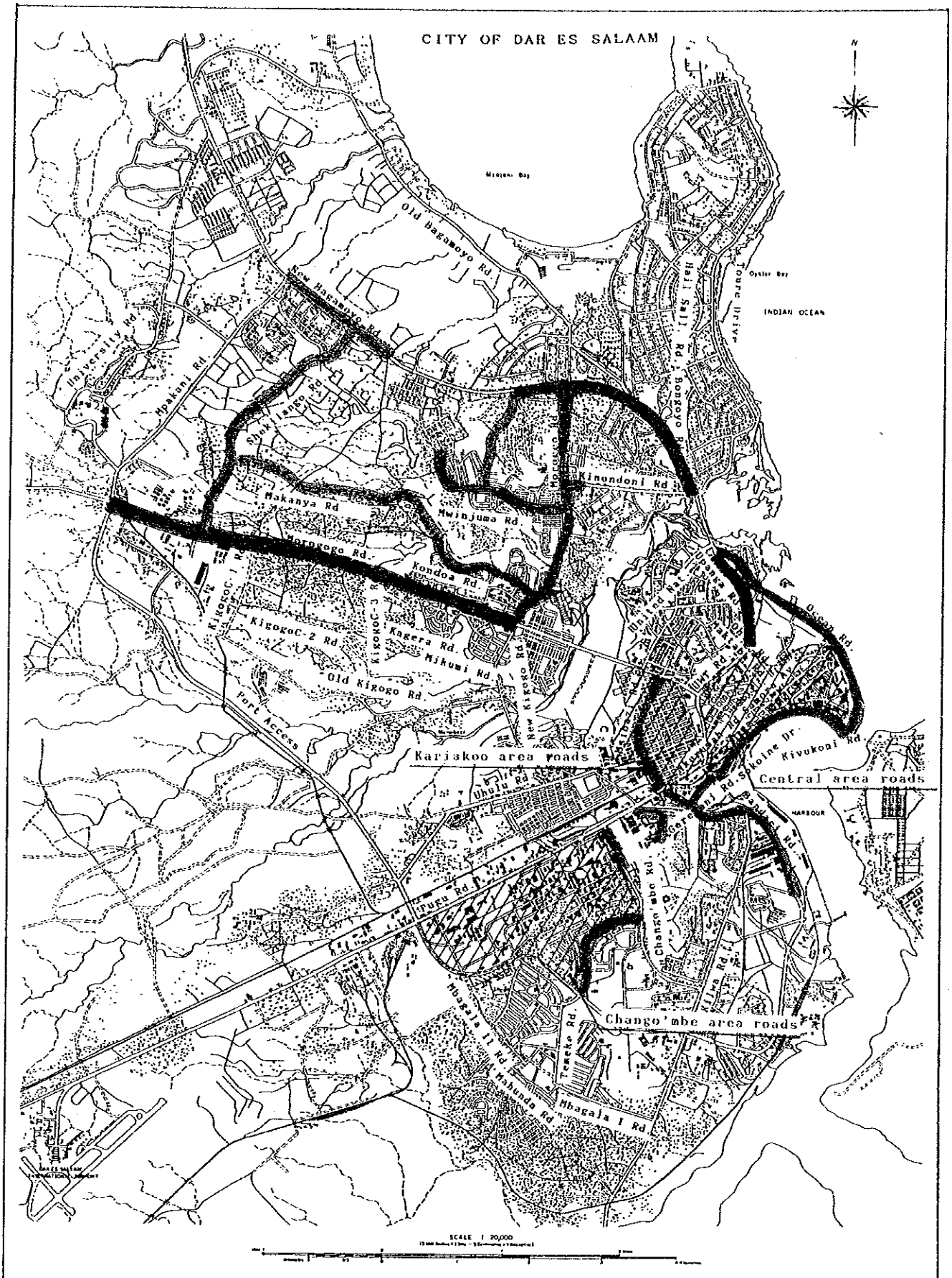


Fig. S-12-1 Project Roads by Improvement Measures

- Maintenance
- Overlay
- Reconstruction
- Widening

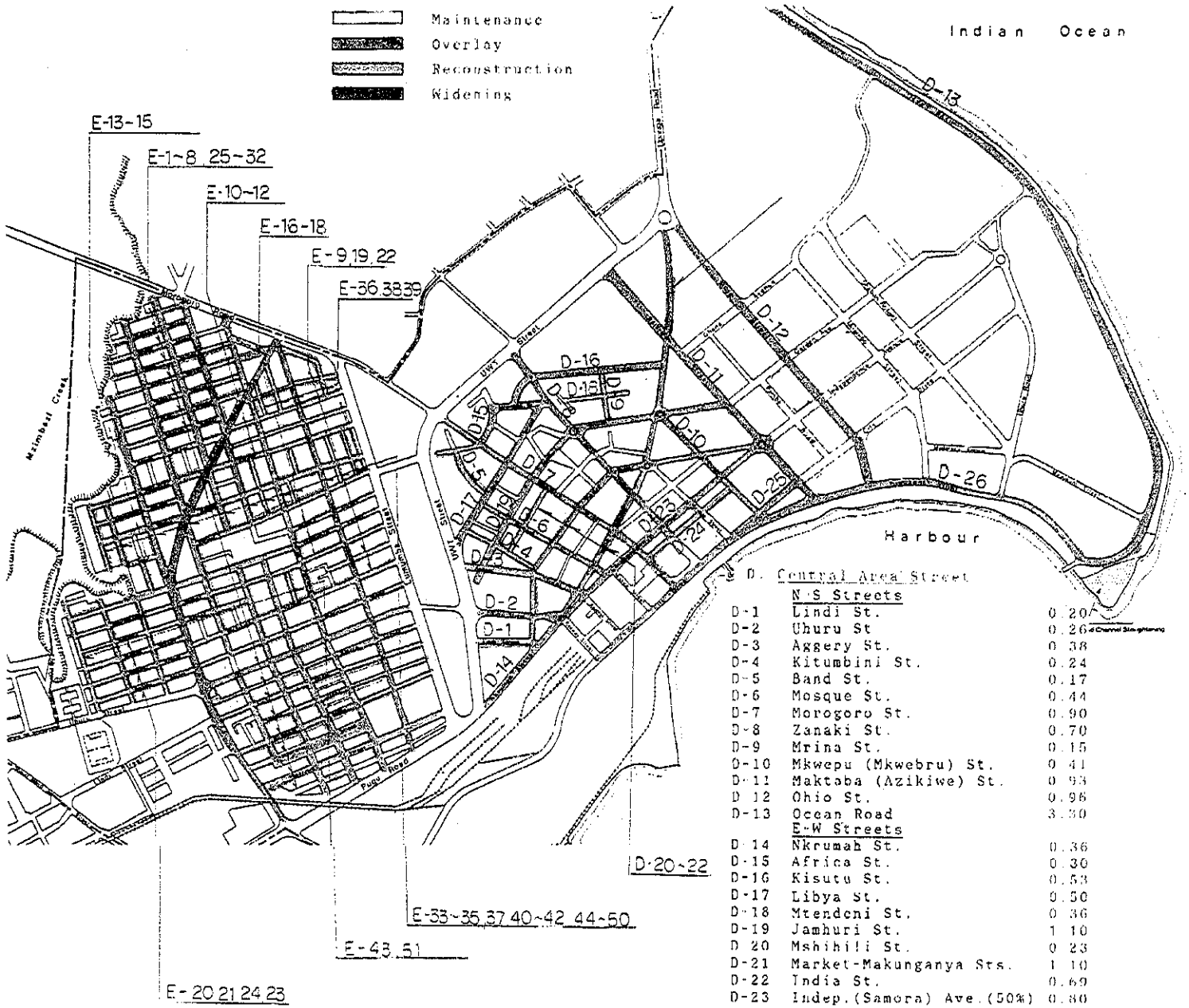


Fig. S-12-2 Area Roads by Improvement Measures (Central and Kariakoo Areas)

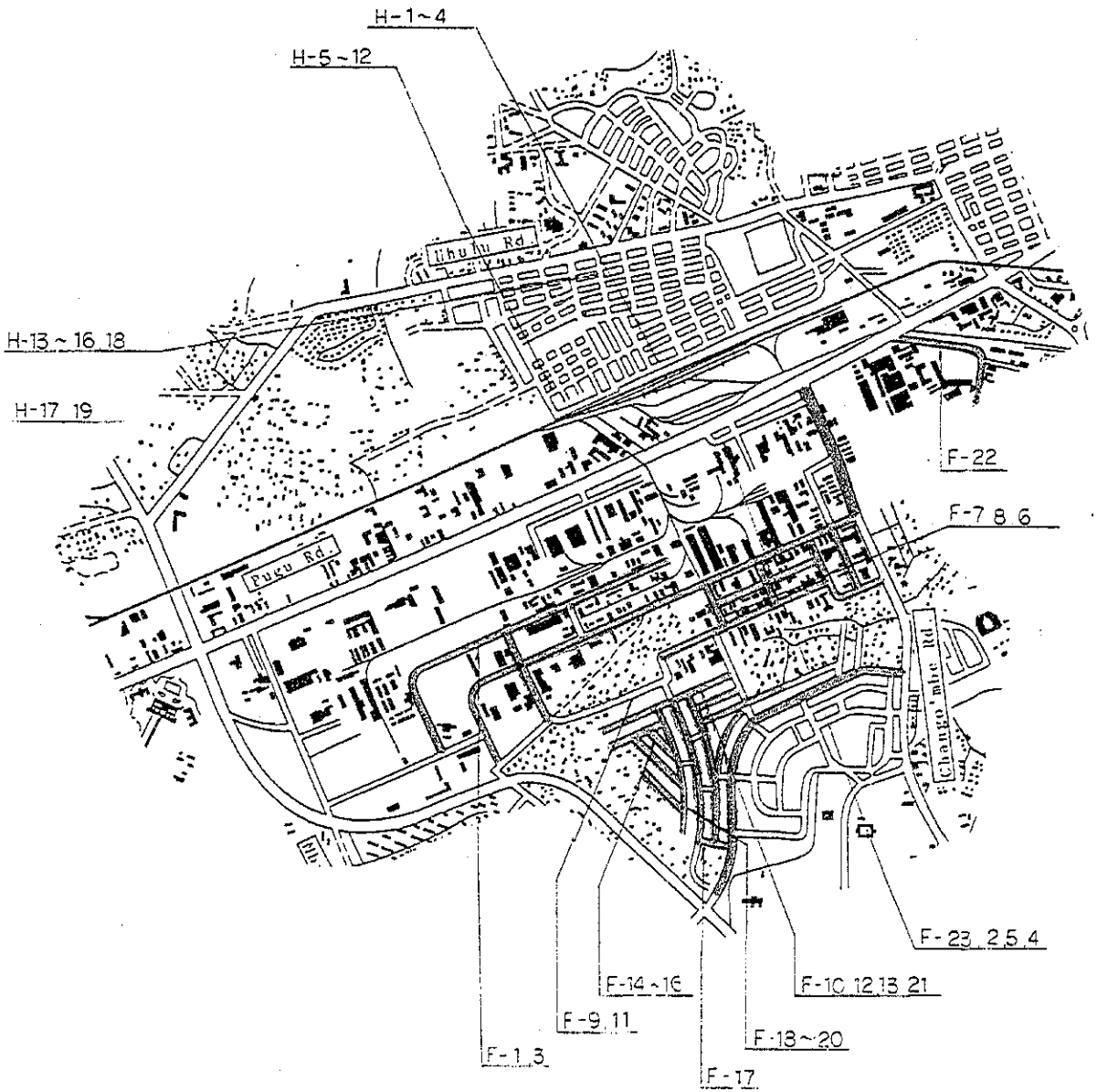
E. Kariakoo Area Commercial Street

	E-W Streets	
E-1	Matumbi (A) St.	0.44
E-2	Matumbi (B) St.	0.24
E-3	Nyati St.	0.36
E-4	Faru St.	0.38
E-5	Twiga St.	0.50
E-6	Ndovu St.	0.40
E-7	Rufiji St.	0.39
E-8	Muhoro St.	0.70
E-9	Ungoni St.	0.30
E-10	Amani St.	0.60
E-11	Udowe St.	0.40
E-12	Kariakoo St.	0.88
E-13	Kibambawe St.	0.27
E-14	Mafia St.	0.83
E-15	Mkunguni St.	0.89
E-16	Pemba St.	0.30
E-17	Tandamuti St.	1.06
E-18	Narung'ombe St.	1.06
E-19	Mahiwa St.	0.23
E-20	Mhonda St.	0.55
E-21	Magila St.	0.32
E-22	Mchikichi St.	0.73
E-23	Aggrey St.	1.07
E-24	Masasi St.	0.32
E-25	Uhuru St.	1.20
E-26	Kipata St.	0.69
E-27	Lindi St.	0.65
E-28	Somali St.	0.60
E-29	Kiungani St..	0.70
E-30	Mbaruku St.	0.39
E-31	Kisarawe St.	0.66
E-32	Viwanda	0.58

	N-S Streets	
E-33	Lumumba St.	1.20
E-34	Nyasa St.	0.16
E-35	Ukami St.	0.15
E-36	Kipande St.	0.16
E-37	Livingstone St.	1.32
E-38	Mvita St.	0.14
E-39	Mivao St.	0.10
E-40	Chura St.	0.17
E-41	Sikuku St.	1.16
E-42	Sukuma St.	0.18
E-43	Gogo St.	0.10
E-44	Swahili St.	1.47
E-45	Wanyamwezi St.	1.34
E-46	Msimbazi St.	1.68
E-47	Kongo St.	1.27
E-48	Jangwani St.	0.59
E-49	Likoma St.	0.63
E-50	Mzizima St.	0.52
E-51	Muheza St.	0.35

D. Central Area Street

	N-S Streets	
D-1	Lindi St.	0.20
D-2	Uhuru St	0.26
D-3	Aggery St.	0.38
D-4	Kitumbini St.	0.24
D-5	Band St.	0.17
D-6	Mosque St.	0.44
D-7	Morogoro St.	0.90
D-8	Zanaki St.	0.70
D-9	Mrina St.	0.15
D-10	Mkwepu (Mkwebru) St.	0.41
D-11	Maktaba (Azikiwe) St.	0.93
D-12	Ohio St.	0.96
D-13	Ocean Road	3.30
	E-W Streets	
D-14	Nkrumah St.	0.36
D-15	Africa St.	0.30
D-16	Kisutu St.	0.53
D-17	Libya St.	0.50
D-18	Mtendeni St.	0.36
D-19	Jamhuri St.	1.10
D-20	Mshihili St.	0.23
D-21	Market-Makunganya Sts.	1.10
D-22	India St.	0.69
D-23	Indep.(Samora) Ave.(50%)	0.80
D-24	Mansfield St.	0.34
D-25	Sokoine(City) Drive(50%)	0.82
D-26	Kivukoni Front	1.22



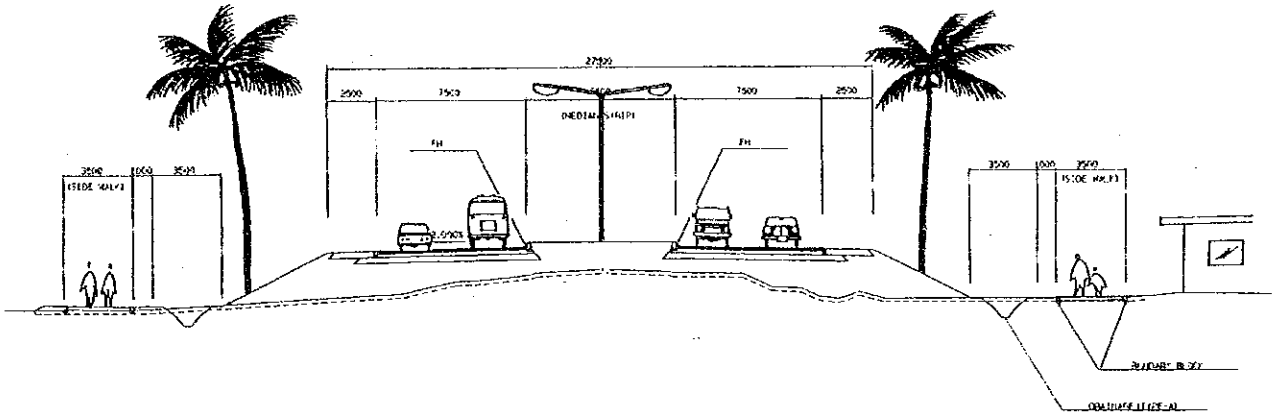
F. Chang'ombe Industrail Area Street

F-1	Saza Road	1.56
F-2	Migeyo Road	0.20
F-3	Mbozi Road	2.20
F-4	Dakawa St.	0.82
F-5	Upper Volta St.	0.49
F-6	Chuma Road	0.54
F-7	Rwanda Road	0.20
F-8	Uruwira Road	0.40
F-9	Wasambara Road	1.20
F-10	Manyara	0.61
F-11	Msikiti	0.25
F-12	Ismailia	0.21
F-13	Rwegasore	0.30
F-14	Kimathi	0.14
F-15	Tagore	0.28
F-16	Ivory Coast	0.38
F-17	Chamwenyewe	0.78
F-18	Mzore Road	0.40
F-19	Ubena	0.61
F-20	Diwani	0.66
F-21	Bazaar	0.27
F-22	Mapinduzi St.	0.80
F-23	Monrovia Road	1.30

Maintenance
Overlay
Reconstruction
Widening

Fig. S-12-3 Area Roads by Improvement Measures
(Chang'ombe Area)

TYPICAL CROSS SECTION OF MOROGORO ROAD



MOROGORO ROAD

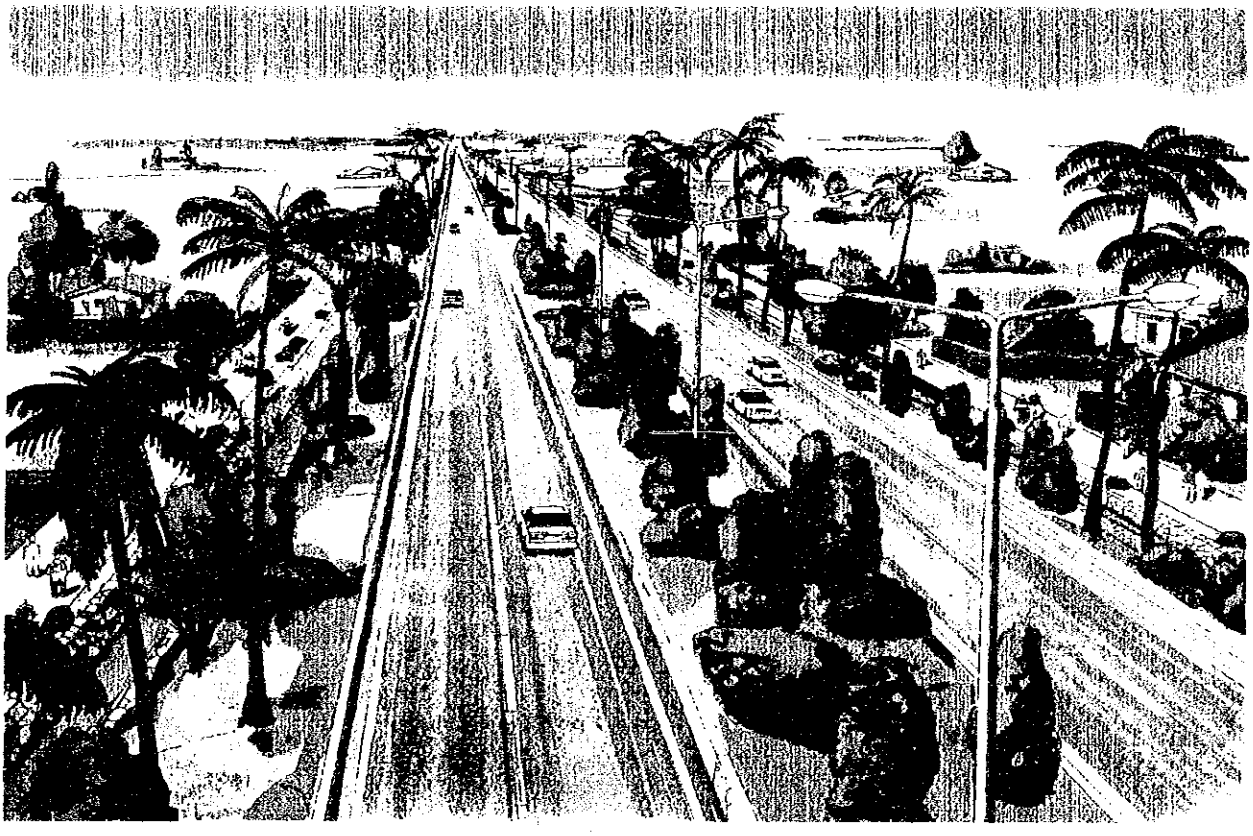
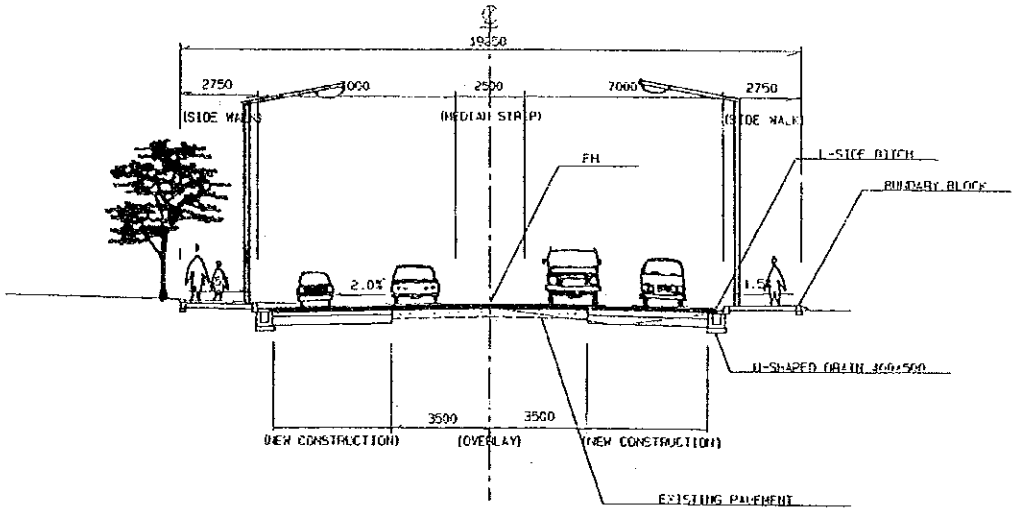
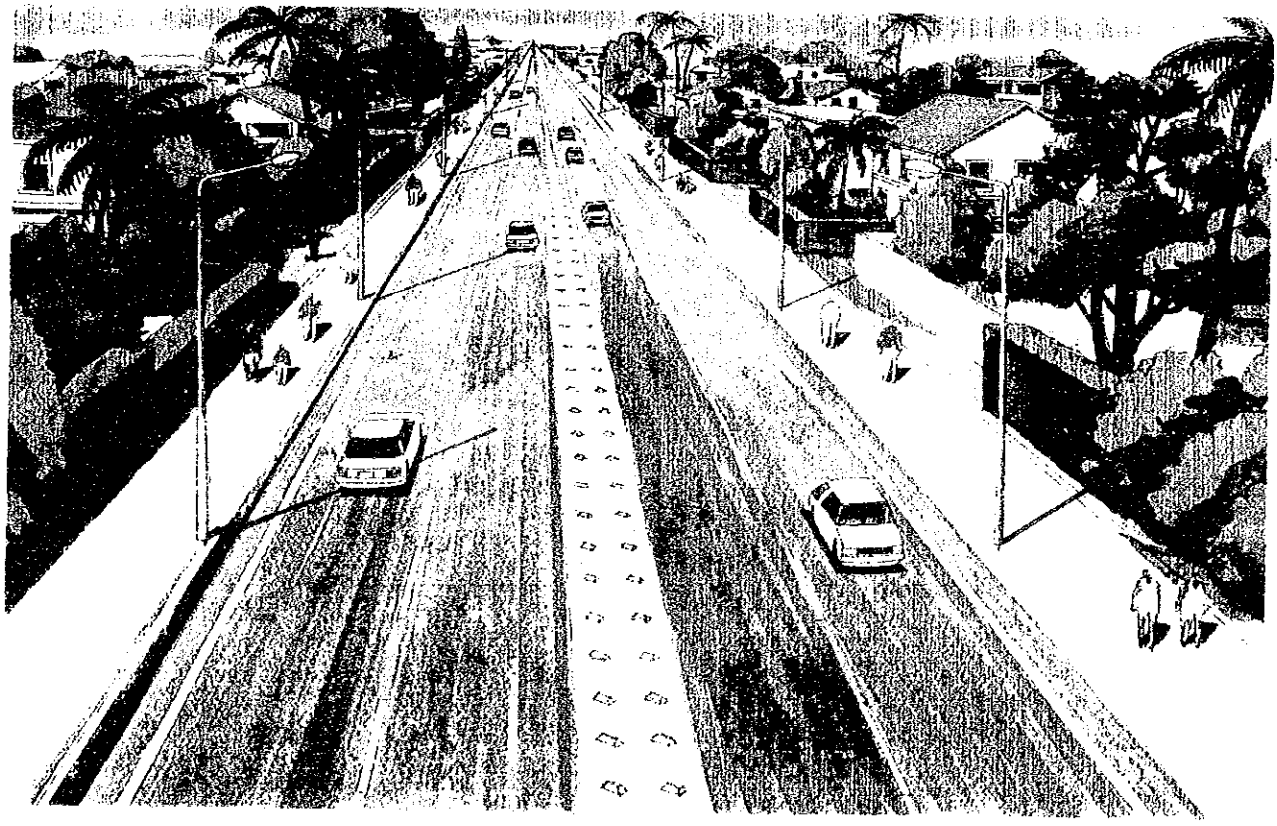


Fig. S.12.4 Typical Cross Sections of Proposed Roads

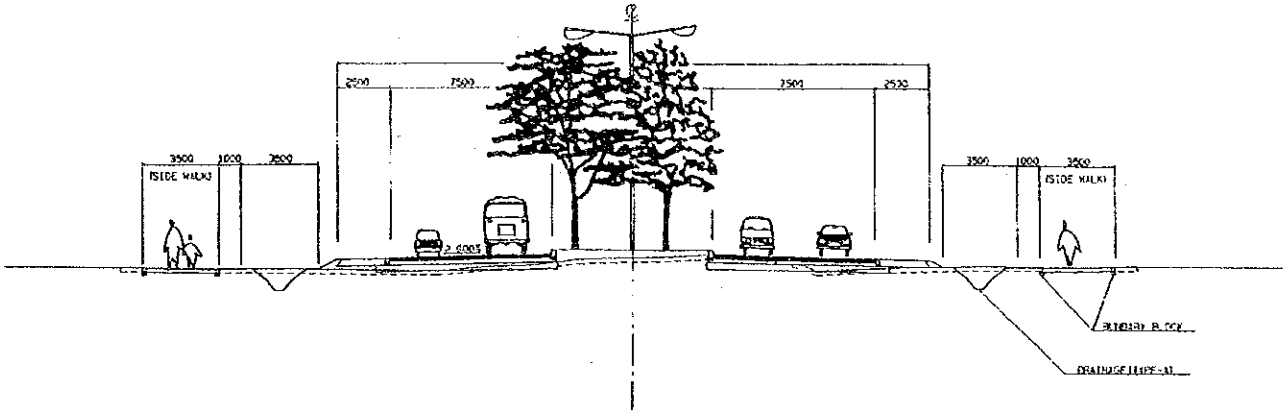
TYPICAL CROSS SECTION OF UPANGA ROAD



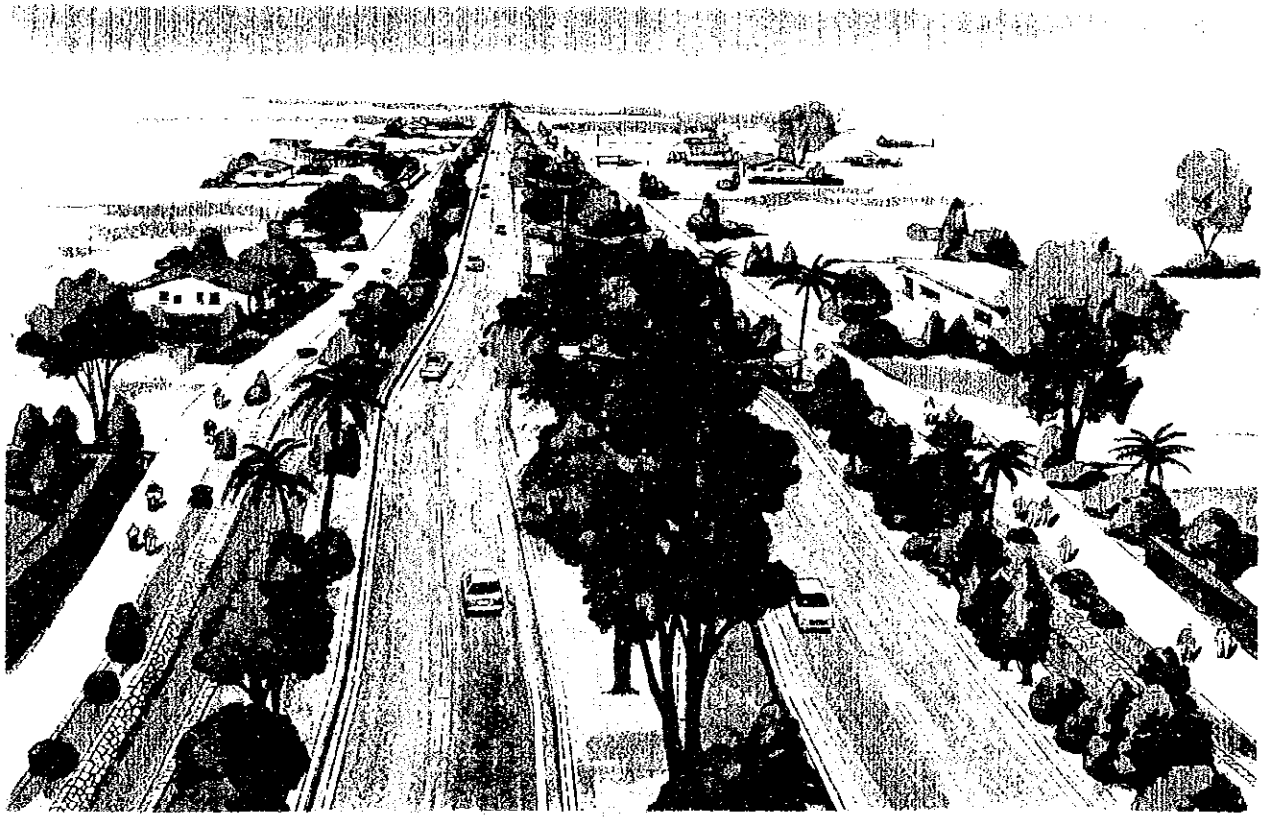
UPANGA ROAD



TYPICAL CROSS SECTION OF NEW BAGAMOYO ROAD



NEW BAGAMOYO ROAD



CHAPTER 13 CONSTRUCTION PLAN AND COST ESTIMATE

13.1 Main Feature of the Project

The construction works consist of improvement of road structures, urgent repair of pot-holes and improvement of road maintenance system. The main features of the Project are summarized in Table S.13.1.

13.2 Construction Plan and Schedule

13.2.1 Construction Conditions

The annual workable days are varried from 216 to 252 days due to nature of construction conditions on each work.

13.2.2 Temporary Construction Facilities

After land compensation, temporary facilities shall be provided prior to commencement of construction works.

13.2.3 Construction Package

-Category A : Improvement of road structures

LOT A-1	New Bagamoyo group	(9.8 Km)
LOT A-2	Morogoro road	(5.7 Km)
LOT A-3	Chang'ombe area group	(19.2 Km)
LOT A-4	Kariakoo area group	(31.7 Km)
LOT A-5	Mwinjuma area group	(16.7 Km)
LOT A-6	Central area group	(21.0 Km)

Category B(LOT B-1) Urgent repair of pot-holes : 206 km

Category C : Improvement of road maintenance system

LOT C-1 Construction of main depot

LOT C-2 Provision of maintenance equipment

-LOT C-2(1) Equipment for main depot

-LOT C-2(2) Equipment for road maintenance

LOT C-3 Guidance and training

13.2.4 Construction Plan and Schedule

Construction period is estimated as shown below.

-Category A : 1990.Dec. - 1994.Mar. (40 months)

-Category B 1990.Dec. - 1992.Mar. (16 months)

-Category C 1990.Dec. - 1994.Mar. (40 months)

13.3 Cost Estimate

13.3.1 Conditions for Cost Estimate

-Price level : October, 1989

-Exchange rates : US$ 1.0 = TShs.144.0 = ¥ 144.0

-Project Cost

A.Construction cost

B.Physical contingency

C.Engineering service cost

D.Relocation cost of public utilities

E.Government administration expense

F.Land Compensation cost

13.3.2 Unit Price

Unit prices for major work items were developed by the Study Team as shown in Table S.13.2. These unit prices shows the direct construction cost(A-2) excluding temporary works(A-1) and indirect expense(A-3).

13.3.3 Major Work Quantities

Majour work quantities are shown in Table S.13.3.

13.3.4 Estimated Project Cost

On the basis of unit prices and quantities, the project cost was estimated as shown in Table S.13.4 and summarized in Table S.13.5.

13.4 Implementation Agency

DCC will be responsible for the implementation of the Project and act as the execution agency for the Project in corporation with MOCW.

13.5 Implementation Programme

Total implementation period is estimated at 46 months. Whole implemented schedule is shown in Figure S.13.1.

13.6 Annual Disbursement Schedule

Fiscal year for the disbursement schedule is assumed to start in April and end in March next year. The project cost is assumed to be disbursed as shown in Table S.13.6.

Table S.13.1 Project Principal Features

NAME OF ROADS	Total Length (km)	Section of Maintenance level (km)	Category A (1) Overlay (km)	(2) Reconst-ruction (km)	(3) Widening (km)	(4) Drainage Structure (km)	(5) Bus bay (nos.)	(6) Inter-section (nos.)	(7) Lightng (nos.)	(8) Signal (nos.)
1. New bagamoyo	**9.8**	**2.3**	**2.3**	**1.4**	**3.9**	**0.2**	**19**	**4**	**91**	**7**
1.1 Up to Morocco J.	3.5	1.0	0.0	0.0	2.5	0.1	3	3	25	4
1.1 Beyond Morocco J.	4.4	1.3	2.0	1.2	0.0	0.0	12	0	0	1
1.13 Upanga	1.9	0.0	0.3	0.2	1.3	0.0	4	1	66	2
2. 1.4 Morogoro (Up to Port Ac.J.)	**5.7**	**0.0**	**0.0**	**0.0**	**5.7**	**0.2**	**16**	**2**	**98**	**3**
3. Chang'ombe Area Group	**19.2**	**5.4**	**4.8**	**9.0**	**0.0**	**0.0**	**0**	**0**	**0**	**0**
3.F Chang'ombe area	14.6	2.6	3.0	9.0	0.0	0.0	0	0	0	0
2.17 Chang'ombe	4.6	2.8	1.8	0.0	0.0	0.0	0	0	0	0
4. Kariakoo Area Group	**31.7**	**3.3**	**3.7**	**24.7**	**0.0**	**0.0**	**0**	**0**	**0**	**0**
3.E Kariakoo area	30.0	3.3	2.0	24.7	0.0	0.0	0	0	0	0
1.11 Msimbazi	1.7	0.0	1.7	0.0	0.0	0.0	0	0	0	0
5. Mwinjuma Area Group	**16.7**	**0.4**	**7.0**	**9.4**	**0.0**	**0.0**	**12**	**8**	**0**	**0**
2.7 Mwinjuma	2.2	0.0	0.8	1.4	0.0	0.0	0	0	0	0
3.I Mwinjuma,L-1	1.5	0.0	0.0	1.5	0.0	0.0	0	0	0	0
1.2 Morocco	3.6	0.0	2.8	0.8	0.0	0.0	12	8	0	0
1.3 Kinondoni	0.7	0.4	0.0	0.4	0.0	0.0	0	0	0	0
2.5 Shekilango	3.8	0.0	2.0	1.8	0.0	0.0	0	0	0	0
2.8 Makanya	5.0	0.0	1.5	3.5	0.0	0.0	0	0	0	0
6. Central Area Group	**21.0**	**0.2**	**17.1**	**3.7**	**0.0**	**0.0**	**0**	**0**	**0**	**3**
3.D Central area	9.8	0.0	6.1	3.7	0.0	0.0	0	0	0	0
1.8 Bandari	2.2	0.2	2.0	0.0	0.0	0.0	0	0	0	0
1.15.1 Nkrumah	0.4	0.0	0.4	0.0	0.0	0.0	0	0	0	0
1.15.3 Sokoine	0.8	0.0	0.8	0.0	0.0	0.0	0	0	0	0
1.15.4 Gerezani	1.4	0.0	1.4	0.0	0.0	0.0	0	0	0	0
1.15.5 Kivukoni	1.2	0.0	1.2	0.0	0.0	0.0	0	0	0	0
1.15.6 Maktaba	0.9	0.0	0.9	0.0	0.0	0.0	0	0	0	3
1.15.7 Ohio	1.0	0.0	1.0	0.0	0.0	0.0	0	0	0	0
1.15.8 Ocean	3.3	0.0	3.3	0.0	0.0	0.0	0	0	0	0
Total	**104.1**	**11.5**	**34.9**	**48.1**	**9.6**	**0.4**	**47**	**14**	**189**	**13**

Table S.13.2 Unit Price List for Major Work Items

(Exchange Rate : 1.0US$ = TShs.144.0 = JYE 144.0)

Item No.	Work	Unit	F/C Portion (TShs.)	L/C Portion (TShs.)	Total (TShs.)
1.EARTH WORKS					
E-1	Clearing and removal of unsuitable materials	sq.m	55	25	80
E-2	Waste excavation,common	cu.m	335	135	470
E-3	Waste excavation,rock	cu.m	530	200	730
E-4	Embankment, borrowed material	cu.m	370	150	520
E-5	Embankment, excavated material	cu.m	230	60	290
E-6	Removal of existing pavement	cu.m	470	200	670
2.PAVEMENT WORKS					
P-2	Sub-base course pavement	cu.m	930	1,930	2,860
P-3	Base course pavement	cu.m	1,630	2,400	4,030
P-4	Shoulder pavement	cu.m	1,470	2,830	4,300
P-5	Prime coat	sq.m	65	5	70
P-6(F)	Asphalt pavement, t=50,100mm	ton	4,210	1,630	5,840
P-7	Sidewalk	sq.m	390	460	850
P-8	Kerb stone	lin.m	310	880	1,190
P-9	Boundary block	lin.m	180	550	730
3.DRAINAGE WORKS					
D-1	Side riprap drainage	sq.m	70	280	350
D-2(B)	Side flume drainage, 400 x 500	lin.m	1,930	4,140	6,070
D-3	L-shaped side ditch	lin.m	590	1,180	1,770
D-6	Pipe culvert,type A, diam.= 600mm	lin.m	2,950	11,750	14,700
D-7(B)	Pipe culvert,type B, diam.= 600mm	lin.m	1,130	8,300	9,430
D-8	Re-installation of existing drainage	lin.m	780	380	1,160

Table S.13.3 Major Work Quantities

Item No.	Description		Unit	Quantity						
				Total	LOT A-1	LOT A-2	LOT A-3	LOT A-4	LOT A-5	LOT A-6
	1.Earth Works									
E-1	Clearing and removal of unsuitable materials		sq.m	301,000	95,000	206,000				
E-2	Waste excavation	common	cu.m	145,000	19,000	51,000	13,000	37,000	20,000	5,000
E-3	Waste excavation	rock	cu.m	10,700	10,700					
E-4	Embankment	borrowed material	cu.m	45,100	11,900	33,200				
E-5	Embankment	excavated material	cu.m	30,400	9,700	20,700				
E-6	Removal of existing pavement		cu.m	63,800	4,300	9,600	12,400	22,600	7,400	7,500
	2.Pavement Works									
P-2	Sub-base course pavement		cu.m	121,000	21,000	32,000	13,000	33,000	15,000	7,000
P-3	Base course pavement		cu.m	84,300	13,600	20,300	9,300	26,600	10,400	4,100
P-4	Shoulder pavement		cu.m	9,100	2,000	7,100				
P-5	Prime coat		sq.m	441,000	75,000	95,000	51,000	136,000	57,000	27,000
P-6	Asphalt pavement		ton	114,000	20,000	22,000	12,000	22,000	19,000	19,000
P-7	Sidewalk		sq.m	68,400	25,800	40,400			2,200	
P-8	Kerb stone		lin.m	18,400	5,500	12,900				
P-9	Boundary block		lin.m	45,300	14,200	30,400			700	
	3.Drainage Works									
D-1	Side riprap drainage		sq.m	10,600	2,400	8,200				
D-2(B)	Side flume drainage	400 x 500	lin.m	4,700	4,700					
D-3	L-shaped side ditch		lin.m	8,900	6,200	2,000			700	
D-4&5	Catch pit and Man hole		nos.	240	140	80			20	
D-7(A)	Pipe culvert	Diam.= 300 mm	lin.m	640		640				
D-6&7(B)	Pipe culvert	Diam.= 600 mm	lin.m	3,490	750	2,740				
D-7(C)	Pipe culvert	Diam.= 1,000 mm	lin.m	360	180	180				
D-8	Re-installation of existing drainage		lin.m	4,990			1,750	2,500		740
	4.Others									
O-1	Road lighting pole	L type	nos.	66	66					
O-2	Road lighting pole	Y type	nos.	123	25	98				
O-3	Traffic signal		sec.	11	8	3				
O-4	Pedestrian bridge		no.	1		1				
O-5	Relocation of utilities	Telephone line	lin.m	11,000	5,300	5,700				
O-6	Relocation of utilities	Water supply valb	nos.	5	5					
O-7	Relocation of utilities	Power supply	lin.m	16,700	5,300	11,400				

Table S.13.4 Total Project Cost

Exchange Rate:1.0US$=TShs.144.0=JYE144.0

Description	F/C Portion (Mil.TShs)	L/C Portion (Mil.TShs)	Total (Mil.TShs)
A.Construction Cost			
A-1 Temporary Works	399.0	171.3	570.3
A-1-1 Direct Works	15.9	11.5	27.4
A-1-2 General Works	77.0	120.3	197.3
A-1-3 Transportation	306.1	39.5	345.6
A-2 Construction Works	1,588.6	1,150.6	2,739.2
A-2-1 Category A	1,299.1	970.2	2,269.3
1)LOT A-1 New Bagamoyo	(320.4)	(217.2)	(537.6)
2)LOT A-2 Morogoro	(398.3)	(316.3)	(714.6)
3)LOT A-3 Chang'ombe	(104.4)	(79.4)	(183.8)
4)LOT A-4 Kariakoo	(223.5)	(193.7)	(417.2)
5)LOT A-5 Mwinjuma	(138.3)	(100.1)	(238.4)
6)LOT A-6 Central	(114.2)	(63.5)	(177.7)
A-2-2 Category B	102.7	87.3	190.0
A-2-3 Category C	186.8	93.1	279.9
1)LOT C-1 Main depot	(87.0)	(93.1)	(180.1)
2)LOT C-2 Equipment	(99.8)	(0.0)	(99.8)
3)LOT C-3 Guidance	(0.0)	(0.0)	(0.0)
A-3 Indirect Expense	368.0	86.1	454.1
A-3-1 Site Expense	197.3	17.1	214.4
A-3-2 Construction expert	75.4	0.0	75.4
A-3-3 General Expense	95.3	69.0	164.3
Total of A	2,355.6	1,408.0	3,763.6
B.Physical Contingency	220.9	135.5	356.4
C.Engineering Service	360.0	90.0	450.0
Total of A to C	2,936.5	1,633.5	4,570.0
D.Relocation Cost	70.0	50.0	120.0
E.Administration Cost	0.0	23.0	23.0
F.Land Compensation	0.0	30.0	30.0
Total of D to F	70.0	103.0	173.0
Grand Total (A to F)	3,006.5	1,736.5	4,743.0

Table S.13.5 Summary of the Project Cost

Items	F/C (Mil.TShs.)	L/C (Mil.TShs.)	Total (Mil.TShs.)
A. Construction Works	2,355.6	1,408.0	3,763.6
B. Physical Contingency	220.9	135.5	356.4
C. Engineering Service	360.0	90.0	450.0
sub-total (A to C)	2,936.5	1,633.5	4,570.0
D. Relocation Cost	70.0	50.0	120.0
E. Administration Cost	0.0	23.0	23.0
F. Land Compensation	0.0	30.0	30.0
Sub-total (D to F)	70.0	103.0	173.0
Grand Total (A to F)	3,006.5	1,736.5	4,743.0

Table S.13.6 Summary of Annual Disbursement Schedule

YEAR	FOREIGN PORTION (Mill.TShs.)	LOCAL PORTION (Mill.TShs.)	TOTAL (Mill.TShs.)
(1)Total Construction Works(Item No.A to C)			
1990/91	874.9	495.1	1,370.0
1991/92	937.3	452.7	1,390.0
1992/93	830.8	529.2	1,360.0
1993/94	293.5	156.5	450.0
Total	2,936.5	1,633.5	4,570.0
(2)Complementary Works(Item No.D to F)			
1990/91	40.0	28.2	68.2
1991/92	30.0	65.4	95.4
1992/93	0.0	7.4	7.4
1993/94	0.0	2.0	2.0
Total	70.0	103.0	173.0

Figure S.13.1 Implementation Schedule

DESCRIPTION	ROAD LENGTH	1st Year 1990/91	2nd Year 1991/92	3rd Year 1992/93	4th Year 1993/94
CONTRACT PHASE AND KEY EVENTS		Phase 1 Contract ▼	Phase 2	Phase 3	Phase 4 Completion ▼
PRE-CONSTRUCTION STAGE Detailed design Tendering		——— ——			
CONSTRUCTION STAGE Preparatory Works	L.S.				
Category A	104.1 km				
A-1 New Bagamoyo Group	9.8 km		LOT A-1		
A-2 Morogoro Road	5.7 km		LOT A-2		
A-3 Chang'ombe Area Group	19.2 km		LOT A-3		
A-4 Kariakoo Area Group	31.7 km			LOT A-4	
A-5 Mwinjuma Area Group	16.7 km				LOT A-5
A-6 Central Area Group	21.0 km		LOT A-6		
Category B	206 km		LOT B-1		
Category C					
C-1 Main Depot	L.S.		LOT C-1		
C-2 Provision of Equipment	L.S.		LOT C-2		
C-3 Training	L.S.			LOT C-3	

CHAPTER 14 ECONOMIC EVALUATION

14.1 General

High priority project roads proposed in the previous chapter are economically evaluated. First of all, the estimated project costs for each of the road improvement and rehabilitation projects are economically evaluated in relation with the expected benefits produced by each project so as to ascertain their economic feasibility from the view point of the national economy. Second, the socio-economic impacts of the project roads are analysed so as to clarify the role of project roads for the realization of better socio-economic conditions in the city of Dar es Salaam and its surrounding areas.

14.2 Results of Economic Evaluation

Project costs estimated in chapter 13 were evaluated in terms of economic costs through three indicators, i.e. Benefit-Cost Ratio (B/C), Net Present Value (NPV) and Internal Rate of Return (IRR). Preposition for the economic evaluation were set up as below;

-Projects to Be Evaluated
A set of high priority projects contained in Category A and C of the short plan is defined as the base for the evaluation.

-Project Life
15 years of project life was assumed.

-Discount Rate
10% of discount rate was applied throughout the project life on the basis of estimated opportunity cost of capital in Tanzania.

The results are far beyond the benchmark values of these indicators and it could be concluded that the Projects are highly feasible. The calculated values of these indicators are shown below;

Table S.14.1 Result of Estimated Indicators

B/C*	NPV(M.Tsh.)*	IRR(%)
2.46	4888.4	25.1

*10% of discount rate was assumed

14.3 Foreseeable Socio-economic Impact from the Project

Besides the above, it is easily expected that the Projects would come up with great amount of socio-economic impact to the surrounding areas. Some of the conceivable impacts are itemized below;

- Promotion of efficient land use plan
- Realization of functional hierarchy among roads
- Enhancement of urban amenities
- Stimulation of regional economy
- Incentive for the succeeding road developement

It is strongly recommended that these impacts be fostered and directed for future urban development in the city of Dar es Salaam.

THE FEASIBILITY STUDY
ON
ROAD IMPROVEMENT AND MAINTENANCE
IN
DAR ES SALAAM

MAIN REPORT

Contents of Main Report
for
The Feasibility Study
on
Road Improvement and Maintenance in Dar es Salaam

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ABBRABIATIONS

AADT	:	Annual Average Daily Traffic
AASHTO	:	American Association of State Highway and Transportation Officals
AC	:	Asphaltic Concrete
ADT	:	Average Daily Traffic
C.R.	:	Congestion Ratio
DCC	:	Dar es Salaam City Council
DSM	:	Dar es Salaam City
DSSD	:	Dar es Salaam Sanitary and Sewarage Department
DBST	:	Double Bituminous Surface Treatment
ESA	:	Equivalent Standard Axles
GDP	:	Gross Domestic Product
GRP	:	Gross Regional Product
IRR	:	Internal Rate of Return
JICA	:	Japan International Cooperation Agency
KAMATA	:	National Buses Company (Kampuni ya Mabasi ya Tiafa)
L.L.	:	Liquid Limit (Atterberg Limits)
MDD	:	Maximum Dry Density
MOCW	:	Ministry of Communications and Works
MT	:	Metric Ton
O-D	:	Origin and Destination
OMC	:	Optimum Moisture Content
p.a.	:	per annum
p.c.u	:	Passenger Car Unit
POSTA	:	Tanzania Posts and Telecommunications
PSI	:	Present Serviceability Index
SBST	:	Single Bituminous Surface Treatment
TANESCO	:	Tanzania Electric Supply Company
TAZARA	:	Tanzania Zambia Rialway Authority
TBST	:	Triple Bituminous Surface Treatment
TRC	:	Tanzania Railways Corporation
TRM	:	Trunk Road Maintenance
UDA	:	Dar es Salaam Transport Corporation (Shirika la Usafiri DSM)
U.S.A.	:	United State of America
VOC	:	Vehicle Operating Cost

CHAPTER 1 INTRODUCTION

1.1 Backgound of the Study

The Government of Tanzania is currently preparing a new five-year Development Plan close coordination to the Economic Recovery Program(ERP), particularly with regard to investment in the key sectors of agriculture and transport. In the transportation sector of the ERP, the national policy priority is given to the maintenance and rehabilitation of the existing roads and the completion of on-going projects.

The road network of Dar es Salaam consists of a total of some 1,150 km, of which 450 km are bitumin roads and 700 km are gravel and earth roads.

Due to the higher rate of city expansion as well as the recent acute increase in vehicle traffic in Dar es Salaam accompanying the recovery of Tanzania's economic situation, the traffic flow on city roads has greatly increased.

Most of the city roads, however, have seriously deteriorated to the extent that normal routine maintenance is no longer cost effective. The deterioration of not only major roads in the urban areas but also local roads in the residential areas is conspicuous.

The excessive damage of the city roads has been caused mainly by the long absence of proper and timely maintenance due to the shortage of funds, small maintenance capacity due to the shortage of equipment and inappropriate policies regarding regular maintenance and rehabilitation.

The deterioration of city roads will persist due to the inadequate capacity of the road maintenance services vis-a-vis the high rate of deterioration.

Since the city roads in Dar es Salaam are of vital importance for the city's economic, social and administrative activities, urgent rehabilitation and improvement measures are essential.

Under this situation, the Government of Tanzania requested the Government of Japan to conduct a feasibility study on road improvement and maintenance in Dar es Salaam (hereinafter referred to as the "Study").

In response to the request, the Government of Japan commissioned the Japan International Cooperation Agency (JICA), the official agency responsible for the implementation of technical cooperation programs of the Government of Japan, to conduct the Study and JICA organized the Advisory Committee and the Study Team for the Study.

1.2 Objectives of the Study

The objectives of the Study are to examine the feasibility of a road improvement and maintenance system for city roads in Dar es Salaam as given below.

- to identify necessary measures and to formulate short, medium and long-term plans for road upgrading and rehabilitation.

- to conduct the preliminary design for high priority roads selected in the short-term plan with a total length of approx. 1000 km and to confirm their economic feasibility.

- to identify the present maintenance problems and to formulate a road maintenance system for Dar es Salaam.

The Study Area, i.e. Dar es Salaam, has a road network of approx. 1,150 km. The roads to be studied have been classified into arterial roads, collector roads and local roads, including streets in urban areas which are under the jurisd-

iction of either the Dar es Salaam City Council or the Ministry of Communications and Works.

1.3 Work Schedule

The Study commenced in mid-March, 1989 and will come to an end in June, 1990. The overall work flow illustrating the relationship of all study activities is given in Fig.1.1. The main items to be studied each year are summarized below.

(1) 1st Field Works in Tanzania (Mar., 1989 - Jun., 1989)
- to conduct the following field surveys and analysis
  * socio-economic study and analysis
  * traffic survey
  * road and drainage conditions survey
  * pavement surveys
  * road maintenance system and equipment survey

(2) 1st Works in Japan (Jul., 1989 - Oct., 1989)
- to analyze data obtained through the field surveys and identify the necessary measures for road improvement
- to select roads for further study (approx. 200 km)
- to determine the priority order of the proposed roads and to formulate short, medium and long-term plans for upgrading and rehabilitation

(3) 2nd Field Works in Tanzania (Oct., 1989 - Dec., 1989)
- to determine high priority roads for further study for the preliminary design (approx. 100 km)
- to conduct the following supplementary surveys on the selected high priority roads
  * topographical survey
  * supplementary pavement survey
  * supplementary traffic survey for intersections
  * drainage and underground facilities survey

(4) 2nd Works in Japan (Dec., 1989 - Mar., 1990)
- to carry out the preliminary design for the selected roads

- to evaluate the economic and technical viabilities
- to identify present maintenance problems and to formulate a road maintenance system for Dar es Salaam

(5) 3rd Works in Japan (Jun., 1990 - Jul, 1990)
- to prepare and submit the final report to the DCC and MOCW

1.4 Organization of the Study

The Study has been carried out by the Study Team under the guidance of the Advisory Committee.

The Dar es Salaam City Council (hereinafter referred to as the "DCC") and Ministry of Communications and Works (hereinafter referred to as the "MOCW") are the counterpart agencies to the Study Team and the DCC is a contact agency acting as a coordinator between other governmental and nongovernmental organizations concerned.

In couse of the Study, the Study Team collaborate closely with the Counterpart Team organized by the DCC and MOCW. Fig.1.2 shows the organization of the Study.

Fig 1.1 OVERALL WORK FLOW

Physical Year	1988 Physical Year (1st year)				1989 Physical Year (2nd year)						
year/month	March	April	May	June	July	August	September	October	November	December	January
Works in Japan											
Works in Tazania											

Main Work Items and Work Procedure

Preparation works in Japan and preparation of the Inception Report

Appraisal Work

2.1.2 Socio-economic Survey
- Review of current data
- Study on land-use and development plans

2.1.3 Analysis of Future Framework
- Establishment of population/economic frame
- Zoning
- Breakdown of future frame by zone

2.1.4 Transport Survey
- airport, port, railway, road and bus

2.1.5 Traffic Survey and Analysis
- Road-side OD survey
- Traffic count survey
- Vehicle running speed survey

2.1.6 Road Inventory Survey and Analysis
- Classification of Road
- Road Inventory Survey
- Drainage Survey

2.1.7 Pavement Survey
- Pavement Surface Condition Survey
- Pavement Structure Survey

2.1.8 Present Road Maintenance Operation System Survey

2.1.9 Analysis on Present Road Condition
- Road Structure
- Traffic Loading
- Pavement Structure
- Pavement Condition
- Geometical Alignment
- Social Policy

Discussion with DCC

Policy of DCC

2.2.1 Forecast of Future Traffic Demand
- Traffic generation Forecast
- Traffic distribution Forecast
- Traffic assignment Forecast

2.2.2 Selection of Road Network for Further Study
- Classification of Road
- Selection of Road Network for Further Study (about 200km)

2.2.3 Identification of Improvement Measures
- Geometric improvement
- Pavement improvement
- Drainage improvement

2.2.4 Preliminary Evaluation
- Preliminary Cost Estimate
- Preliminary evaluation

2.2.5 Analysis on Present Rord Maintenance Operation System

2.2.6 Formulat on of Road Improvement Plan
- Short- erm Plan
- Middle -term Plan
- Long-term Plan

2.3.1 Selection of High Priority Project (100km)

2.3.2 Determination of Design Criteria

2.3.3 Supplementary Survey
- Topographical Survey
- Underground facility Survey
- Traffic Survey on Intersections
- Pavement Structure Survey
- Drainage Structure Survey
- Construction Material Survey

2.3.4 Collection of Construction Data

2.3.5 Estimation of Benefits
- Analysis of Transport Cost
- Estimation of Benefits

Disussion with DCC

2.4.1 Preliminary Engineering Design
- Upgrading
- Rehabilitation
- Overlay
- Intersection Improvement

2.4.2 Constrution Plan and Cost Estimates

2.4.3 Economic Analysis and Evaluation

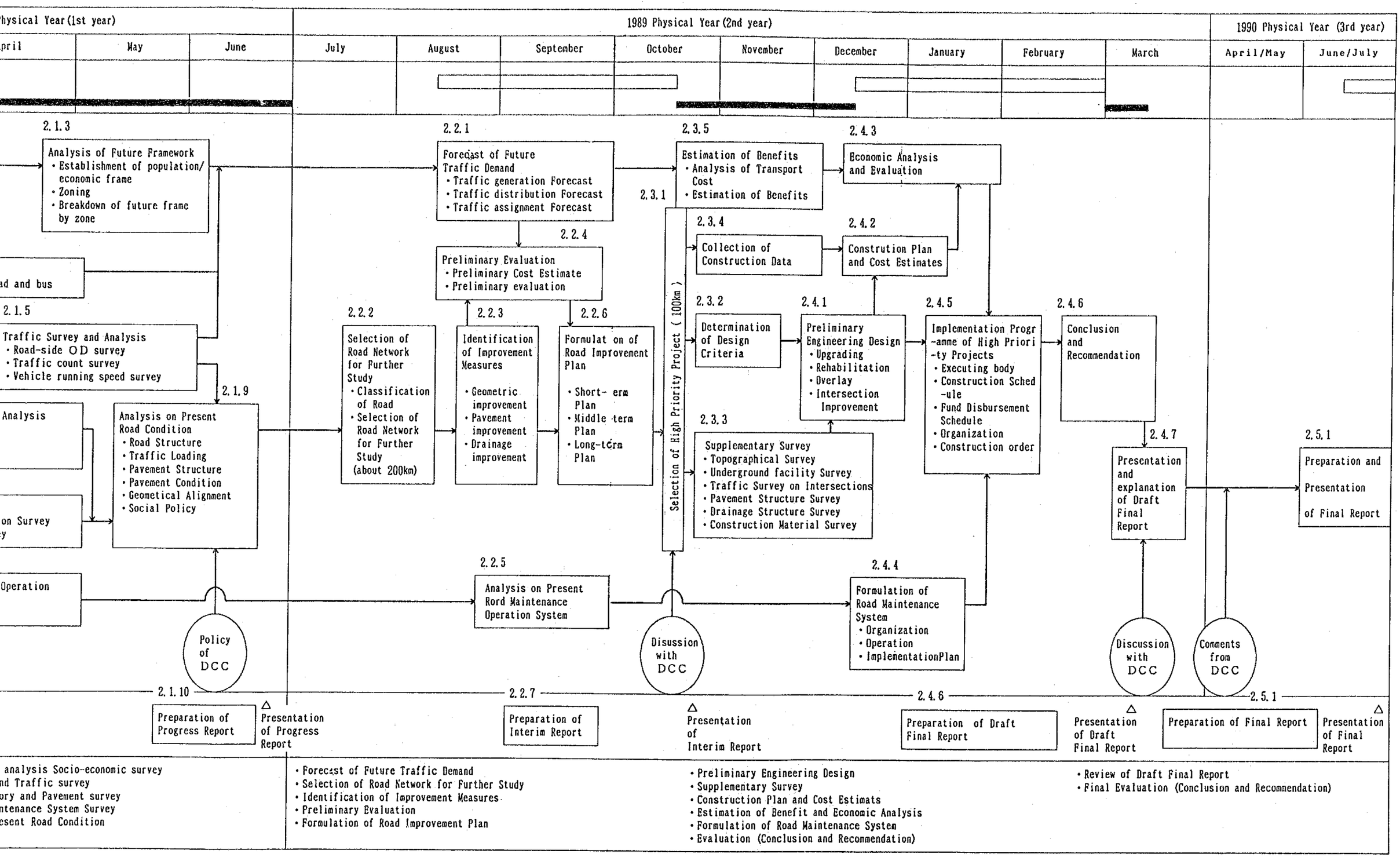
2.4.4 Formulation of Road Maintenance System
- Organization
- Operation
- ImplementationPlan

2.4.5 Implementati -amme of Hig -ty Projects
- Executing
- Constructi -ule
- Fund Disbu Schedule
- Organizati
- Constructi

2.4.6 Preparation of Final Report

Reports	Preparation of Inception Report; △ Presentation of Inception Report	2.1.10 Preparation of Progress Report; △ Presentation of Progress Report	2.2.7 Preparation of Interim Report; △ Presentation of Interim Report
Main Out-puts	• Existing condition and analysis Socio-economic survey • Results of Transport and Traffic survey • Results of Road Inventory and Pavement survey • Results of Present Maintenance System Survey • Analysis results on Present Road Condition	• Forecast of Future Traffic Demand • Selection of Road Network for Further Study • Identification of Improvement Measures • Preliminary Evaluation • Formulation of Road Improvement Plan	• Preliminary Engineering Design • Supplementary Survey • Construction Plan and Cost Estimats • Estimation of Benefit and Economic Analysis • Formulation of Road Maintenance System • Evaluation (Conclusion and Recommendation)

RK FLOW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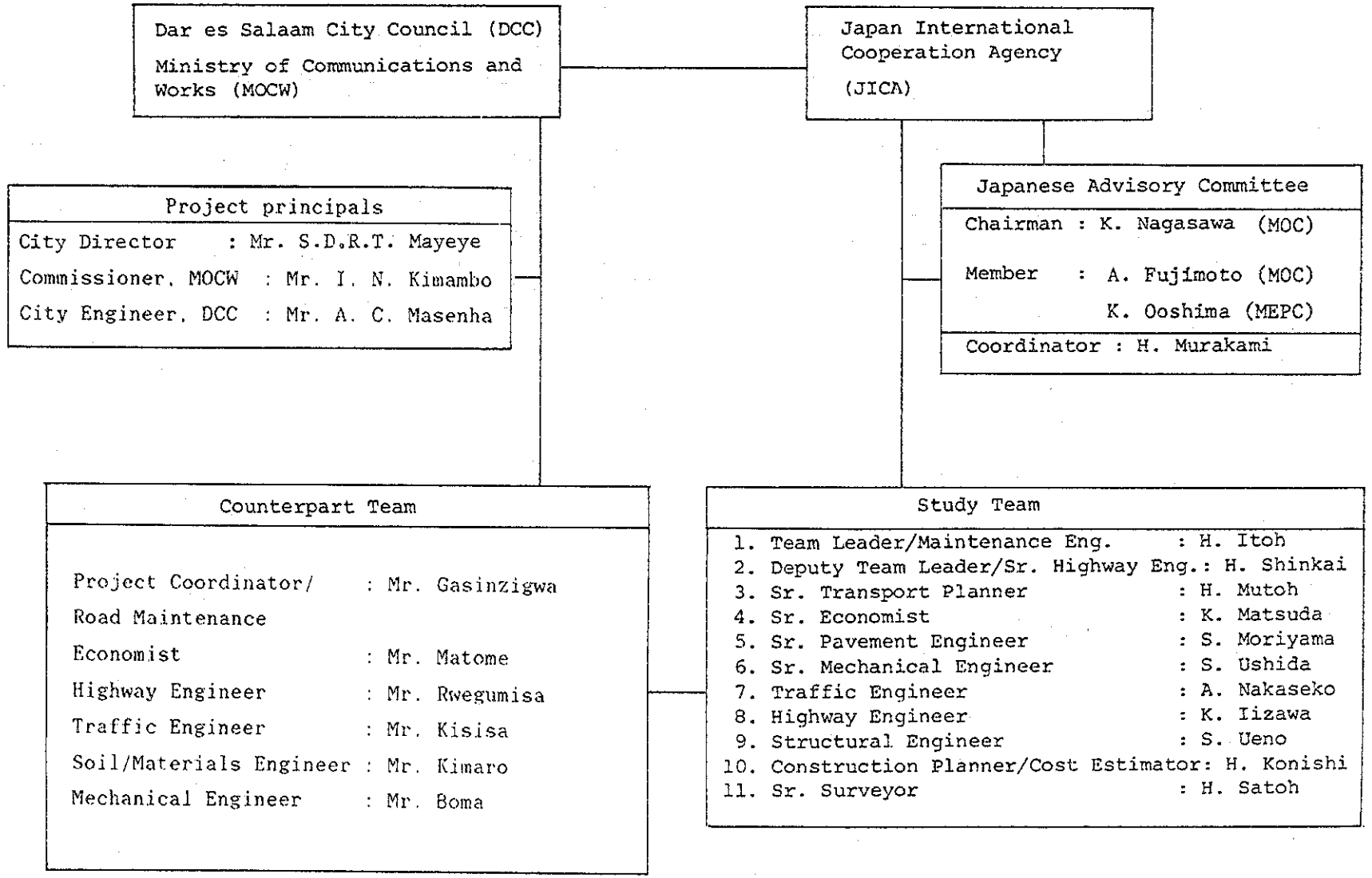
• Formulation of Road Maintenance System
• Evaluation (Conclusion and Recommendation)
• Review of Draft Final Report
• Final Evaluation (Conclusion and Recommendation)

Fig. 1.2 ORGANIZATION OF THE STUDY



CHAPTER 2 OUTLINE OF THE STUDY AREA

2.1 Characteristics of the Study Area

The United Republic of Tanzania is located on the eastern coast of East Africa between latitude 1^{o}- 11^{o} south. It has a total area of 945,087 km^2 and a population of approximately 23 million according to a census conducted in 1988.

The Study Area covers the entire city of Dar es Salaam which also forms the Dar es Salaam Region, one of the 20 mainland political regions of Tanzania.

Dar es Salaam lies on a coastal plain with the Indian Ocean to the east and the Pugu Hills to the west. The coastal plain is traversed by a number of rivers, notably the Msimbazi and Mzinga Rivers, which divide the urban area.

The lowest average monthly temperature in Dar es Salaam is $23.3^{o}C$(July) while the highest average monthly temperature is $27.6^{o}C$(Feb.and March), with April being the most sultry with humidity of 82%. There are two rainy seasons, i.e. March-April and October-November, with annual rainfall of 1,000-1,100mm while the rest of the year being dry.

Dar es Salaam is the main city of Tanzania and is the country's administrative, commercial and industrial center.

Dar es Salaam is the smallest region of Mainland Tanzania with 1,393km^2, 0.16% of the mainland area, and is the biggest city with a population of 1.36 million in 1988, 6.2% of the mainland's population.

2.2 Socio - Economic Situations

2.2.1 Administration

The Study Area (City/Region of Dar es salaam) is divided into 3 administrative district and 52 wards with the following important data from the 1988 census.

-Temeke District:

Location: South of the city/Region
Area: 684 square kilometres
Population: Total - 405,753
Urban - 273,097
Rular - 132,656
Households: 95.505/average of 4.2 people household
Wards: 16 wards

-Kinondoni District:

Location: North of the city/Region
Area: 501 square kilometres
Population: Total - 621,389
Urban - 565,006
Rural - 56,383
Households: 143,669/average of 4.3 people per household
Wards: 18 wards

-Ilala District:

Location: Central part of city/Region
Area: 208 square kolimetres
Population: Total - 333,708
Urban - 265,880
Rural - 67,828
Households: 75,130/average of 4.4 people per household
Wards: 18 wards

-City/Region

Location: East/Coast of Tanzania Mainland
Area: 1,393 square kilometres
Population: Total - 1,360,850
Urban - 1,103,983

Rural - 256,867

Households: 314,304/average of 4.3 people per household

Wards: 52 wards

The city Council elected every 5 years under the universal suffrage system and consists of the Lord Mayor, Council Secretary, Deputy Mayor and the Chairman of each of the 10 departments.

The City Council services are provided by City Council staff of about 15,000, headed by the City Director and supported by 2 Deputy Directors (one for urban and one for rural areas) and 11 heads of departments. The Director reports to the Council and to the Principal Secretary of the Ministry of Local Government, Community Development, Cooperatives and Marketing.

Under the decentralisation of the City Council services, each district will have a fully fledged staff of similar qualifications to the Head Office.

Table 2.1 and Table 2.2 show the recurrent and development expenditure of the City Council budget for the period between 1983/84 and 1987/88.

The total recurrent expenditure of the City was 501.6 million T.Shs in 1987/88. The recurrent expenditure of the Engineering Department was 84.9 million T.Shs, approx. 16% of the total. The average share of the Engineering Department's expenditure was about 21% of the total expenditure in the period between fiscal 1983/84 and 1987/88.

The total development expenditure of the City from 1983/84 to 1987/88 was 216.4 million T.Shs, comprising approx. 12% of the total recurrent expenditure of the City which was 1,821.3 million T.Shs. in the same period.

Table 2.1 Recurrent Expenditure of DCC

Year	Recurrent Expenditure (T.Shs.000) Total DCC	Engineering department	(%)
1983/84	188,454.5	33,507.0	17.8
1984/85	357,923.9	118,146.0	33.0
1985/86	333,722.1	67,915.0	20.2
1986/87	437,614.7	70,893.1	16.2
1987/88	501,635.4	84,933.8	16.9
Total	1,821,349.6	375,394.9	20.6
Average Annual Increase Rate	28%	26%	-

Table 2.2 Development Expenditure of DCC

Year	Development Expenditure (T.Shs.000) Total DCC	Road Construction Rehabilitation	(%)
1983/84	10,812.0	5,135.0	47.5
1984/85	42,852.0	7,827.0	18.3
1985/86	22,606.0	6,802.0	30.1
1986/87	56,413.0	16,838.0	29.8
1987/88	83,780.0	40.640.0	48.5
Total	216,463.0	77,242.0	35.7
Average Annual Increase Rate	67%	68%	-

Development expenditure for road construction/ rehabilitation constitutes an important position in the total development expenditure, sharing about 36% of the total during the period between fiscal 1983/84 and 1987/88.

2.2.2 Population and Employment

(1) Population

The population census conducted in 1967 and 1978 by the Bureau of Statistics, Ministry of Finance, Economic Affairs and Planning show the population trend of Tanzania.

Tanzania had a population of 12,323,469 in 1967, 17,512,610 in 1978 and 23,174,336 in 1988. The average annual population increase rate declined from 3.2% in the period between 1967 and 1978 to 2.8% in the decade between 1978 and 1988 due to increased birth control.

Table 2.3 shows the population distribution by region for 1967, 1978 and 1988. The Dar es Salaam Region's population of 356,286 in 1967 accounted for 2.9% of Tanzania's total population, incresing to 843,090 (4.8%) in 1978 and further to 1,360,850 (5.9%) in 1988.

The urbanization and development of Dar es Salaam progressed between 1967 and 1978. The low growth rate of 4.9% per annum between 1948 and 1957 increased to 7.8% per annum between 1967 and 1978. With the establishment of the Dar es Salaam Master Plan and the introduction of industrial decentralization, however, the growth rate of the Dar es Salaam has been decreasing, from 7.8% between 1967 and 1978 to 4.8% between 1978 and 1988 althogh it is still the highest growth rate among all the regions.

Table 2.3 Population of Tanzania by Region

Region	Population (Number) 1967 (%)	1978 (%)	1988 (%)	Average Annual Growth Rate(%) 1967-78	1978-88
Dodoma	709,380(5.8)	972,005(5.6)	1,237,819(5.3)	2.9	2.4
Arusha	610,474(5.0)	926,224(5.3)	1,351,675(5.8)	3.8	3.8
Kilimanjaro	652,722(5.3)	902,437(5.2)	1,108,699(4.8)	2.9	2.1
Tanga	771,060(6.3)	1,037,767(5.9)	1,283,636(5.5)	2.7	2.1
Morogoro	682,700(5.5)	939,264(5.4)	1,222,737(5.3)	2.9	2.6
Coast	428,041(3.5)	516,586(2.9)	638,015(2.8)	1.7	2.1
Dar es Salaam	356,286(2.9)	843,090(4.8)	1,360,850(5.9)	7.8	4.8
Lindi	419,853(3.4)	527,624(3.0)	646,550(2.8)	2.1	2.0
Mtwara	621,293(5.0)	771,818(4.4)	889,494(3.8)	2.0	1.4
Ruvuma	395,447(3.2)	561,575(3.2)	783,327(3.4)	3.2	3.4
Iringa	689,905(5.6)	925,044(5.3)	1,208,914(5.2)	2.7	2.7
Mbeya	753,765(6.1)	1,079,864(6.2)	1,476,199(6.4)	3.3	3.1
Singida	457,938(3.7)	613,949(3.5)	791,814(3.4)	2.7	2.5
Tabora	502,068(4.1)	817,907(4.7)	1,036,293(4.5)	4.4	2.4
Rukwa	276,091(2.2)	451,897(2.6)	694,974(3.0)	4.5	4.3
Kigoma	473,443(3.8)	648,941(3.7)	854,817(3.7)	2.9	2.8
Shinyanga	899,468(7.3)	1,323,535(7.6)	1,772,549(7.6)	3.5	2.9
Kagera	658,712(5.3)	1,009,767(5.8)	1,326,183(5.7)	3.9	2.7
Mwanza	1,055,883(8.6)	1,443,397(8.2)	1,878,271(8.1)	2.8	2.6
Mara	544,125(4.4)	723,827(4.1)	970,271(4.2)	2.6	2.9
Mainland	11,958,654(97.1)	17,036,499(97.3)	22,533,758(97.2)	3.2	2.8
Zanzibar	354,815(2.9)	476,111(2.7)	640,578(2.8)	2.7	3.0
Tanzania	12,313,469(100.)	17,512,610(100.)	23,174,336(100.)	3.2	2.8

Table 2.3 also shows the different growth rates of the different regions which can be explained by the internal migration of the population. High growth rates of 4.8% in Dar es Salaam, 4.3% in Rukwa, 3.8% in Arusha, 3.4% in Ruvuma and 3.1% in Mbeya were recorded between 1978 and 1988.

The regional population distribution pattern changed little between 1978 and 1988 except for those regions with high growth rates.

(2) Employment

Table 2.4 gives the current employment statistics for the Dar es Salaam Region and for the Mainland based on past and present data of the Bureau of statistics.

The total employment in Dar es Salaam increased from 87,000 in 1976 to approximately 186,000 in 1984 with an annual growth rate of 10.0% while an annual growth rate of 7.4% was recorded for the employment of the mainland in the same period.

Table 2.5 shows the current employment by sector in Dar es Salaam based on data of the Bureau of Statistics and the Dar es Salaam Master Plan.

The total employment in Dar es Salaam is approximately 231,300 as of 1988, an increase of about 3.92 times on 1966. The employment/population ratio of 18% in 1988 appears steady. The employment composition and structure by sector is also analysed in Table 2.5 and the share of manufacturing and commerce has noticeably increased.

Table 2.4 Existing Employment in Dar es Salaam and Mainland

	Employment								Growth Rate
	1976	1977	1978	1979	1980	1982	1983	1984	1976-84
Dar es Salaam:									
	86,569	107,820	120,896	129,373	129,526	179,558	182,034	185,954	10.0%
Mainland:									
	357,590	366,390	405,195	456,712	648,227	631,637	633,157	633,179	7.4%

source: "Statistical Abstract 1982" and latest data from the Bureau of Statistics

Table 2.5 Existing Employment by sector in Dar es Salaam

	Employment and Structure by sector					
	1966	1979	1982	1983	1984	1988(1)
1. Manufacturing	13,219	37,410	46,025	47,279	48,945	64,800
	(22.4)	(29.0)	(25.6)	(26.0)	(26.3)	(28.0)
2. Commerce	6,937	14,000	26,093	27,096	28,235	37,000
	(11.7)	(10.8)	(14.5)	(14.9)	(15.2)	(16.0)
3. Public Service	16,529	33,000	61,067	61,348	62,256	74,200
and Utilities	(28.0)	(25.6)	(34.0)	(33.7)	(33.5)	(32.0)
4. Transport and	11,655	26,000	38,168	38,736	39,520	46,300
Communications	(19.7)	(20.1)	(21.3)	(21.3)	(21.3)	(20.0)
5. Construction	10,028	16,000	6,162	5,620	5,205	6,900
	(17.0)	(12.4)	(3.4)	(3.1)	(2.8)	(3.0)
6. Mining	49	90	463	460	416	500
	(0.1)	(0.1)	(0.3)	(0.3)	(0.2)	(0.2)
7. Agriculture	653	2,600	1,580	1,495	1,377	1,600
	(1.1)	(2.1)	(0.9)	(0.8)	(0.7)	(0.8)
Total Employment	59,070	129,100	179,558	182,034	185,954	231,300
	(100.0)	(100.0)	(100.0)	(100.0)	(100.0)	(100.0)
Total Employment/Population	18%	15%	18%	17%	17%	17%
Population	332,000	883,600	1,017,000	1,065,800	1,117,000	1,360,850

(1): Figures are estimated useing existing statistics by the Study Team.

2.2.3 Gross Regional Product

The Gross Domestic Product (GDP) of Tanzania are only available data for the analysis of the Gross Regional Product from the Bureau of Statistics.

The GDP of Tanzania was in the order of 198.1 billion shillings with a per capita GDP of about 8,800 shillings in 1987 as shown in Appendix 2-1. Beside the GDP at 1976 constant price is shown in Appendix 2-2.

The GDP grew by an average of 2.0% per annum in real terms between 1977 and 1987 as shown in Table 2.6.

A High annual growth rate of 3.9% was recorded in 1986 and a growth rate of about 4.0% is forecasted in 1988.

The annual economic growth rate between 1984 and 1987 was slightly higher than the annual population growth rate of 2.8% per.

As in the previous years, agriculture was the main source of GDP growth. As a result of the real output growth and a shift in relative prices, the proportion of the GDP at current prices accounted for by the agricultural sector rose to 59% compared to a ratio of 42% in 1978 with an average annual growth rate of 2.8% between 1977 and 1987 as shown in Appendix 2-3.

In comparison, industry has remained depressed with the manufacturing sector accounting for only 4.4% of the GDP in 1987 compared to 13% in 1978. However, growth in output of 4.2% was registered in 1987 due to the recovery of the Tanzanian economy. (see Table 2.6)

Table 2.6 Annual Growth Rate of GDP by Economic Activity, 1976 prices

(%)

Economic Activity	'78	'79	'80	'81	'82	'83	'84	'85	'86	'87	'88	Ave. Annual Growth Rate 1977-87
1. Agriculture, Forestry, Fishing and Hunting	-1.7	0.8	3.9	1.0	1.3	2.9	4.0	6.0	5.7	4.4	-	2.8
2. Mining and Quarrying	-18.2	5.8	-5.5	2.1	-	-9.8	6.9	-6.5	-4.0	-1.2	-	-3.3
3. Manufacturing	3.4	3.3	-4.9	-11.2	-3.3	-8.7	2.7	-3.9	-4.0	4.2	-	-2.4
4. Electricity and Water	17.2	11.1	25.8	4.3	0.7	-1.7	6.3	5.0	18.0	7.5	-	9.1
5. Construction	-14.4	12.3	6.0	-4.5	4.5	-41.0	20.2	-8.9	25.1	2.9	-	-1.7
6. Whole sale and retail, trade, hotels and restrants	5.4	1.5	-	-4.0	-2.1	-2.1	1.1	0.8	10.9	4.5	-	1.0
7. Transport and Communication	2.8	-3.8	11.1	-9.1	2.5	-13.0	0.6	1.8	0.3	4.5	-	-0.4
8. Finance, Insurance, Real Estate and Business services	5.7	5.9	6.2	1.9	6.8	4.3	5.9	2.1	7.8	2.4	-	4.9
9. Public Administration and other services	20.0	8.6	-2.1	11.1	0.1	-0.4	0.2	1.9	-9.2	0.8	-	2.9
Total Industries	2.2	2.9	2.6	-0.4	1.1	-2.1	3.4	2.7	3.9	4.0	-	2.0

2.2.4 Present Land Use

The present Land Use map and the informations of Land-Use trend have been prepared by the City Planning Department as shown in the Fig 2.1.

The Land Use map for 1978 shown in Fig.2.2. prepared for the Master Plan study shows the extent of urbanization as follows:

-Extension of planned residential area in the north-west corridor along Bagamoyo Road, in the south corridor along Kilwa Road and in the Tabata area.

-Extension of unplanned residential area in the west corridor along Morogoro Road, in the south-west corridor along Pugu Road and in the south corridor along Kilwa Road.

-Extension of Industrial areas north of Bagamoyo Road, west of Port Access Road, along Pugu Road and part of the Kinondoni area.

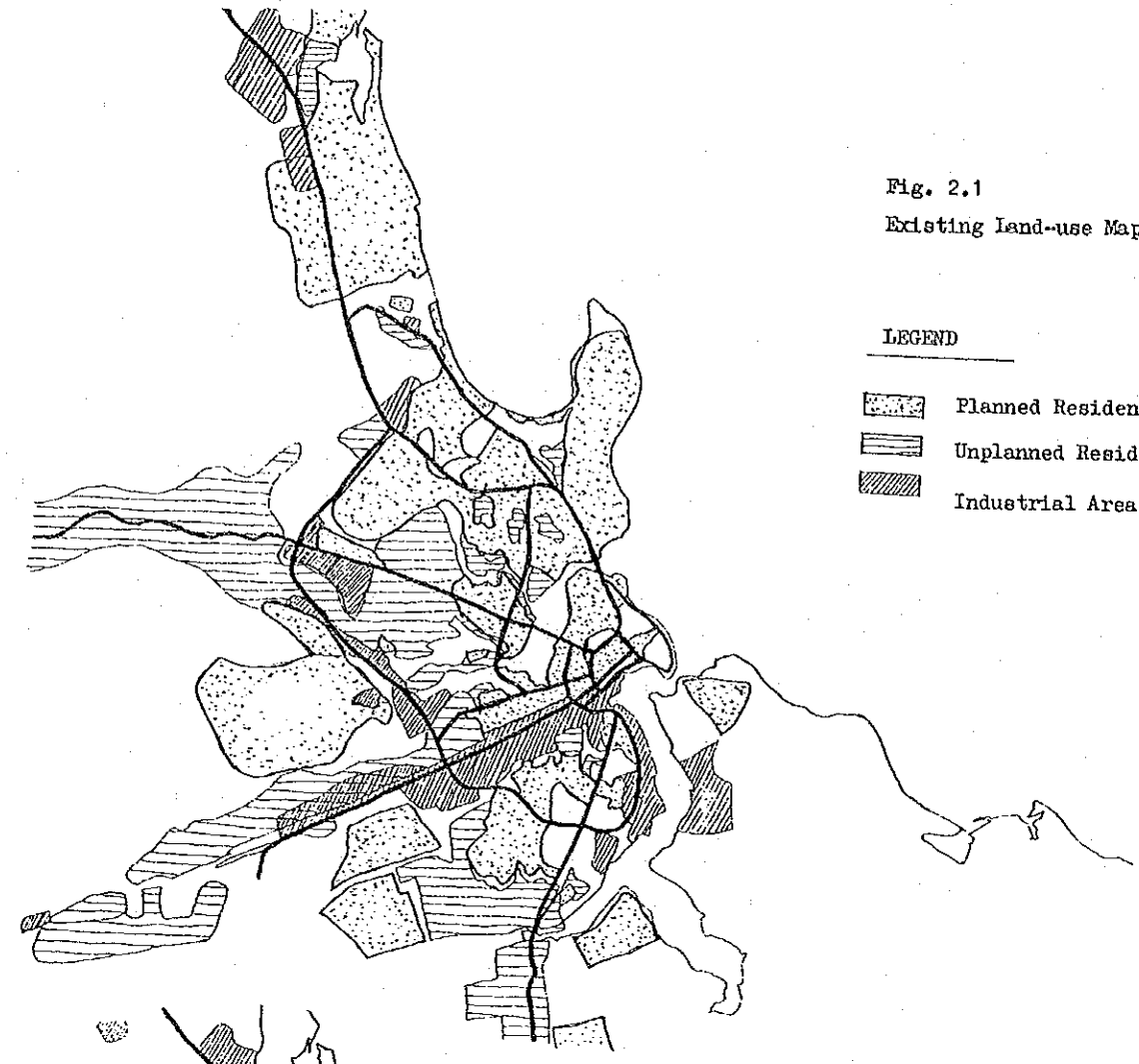


Fig. 2.1
Existing Land-use Map in 1989

LEGEND

- Planned Residential Area
- Unplanned Residential Area
- Industrial Area

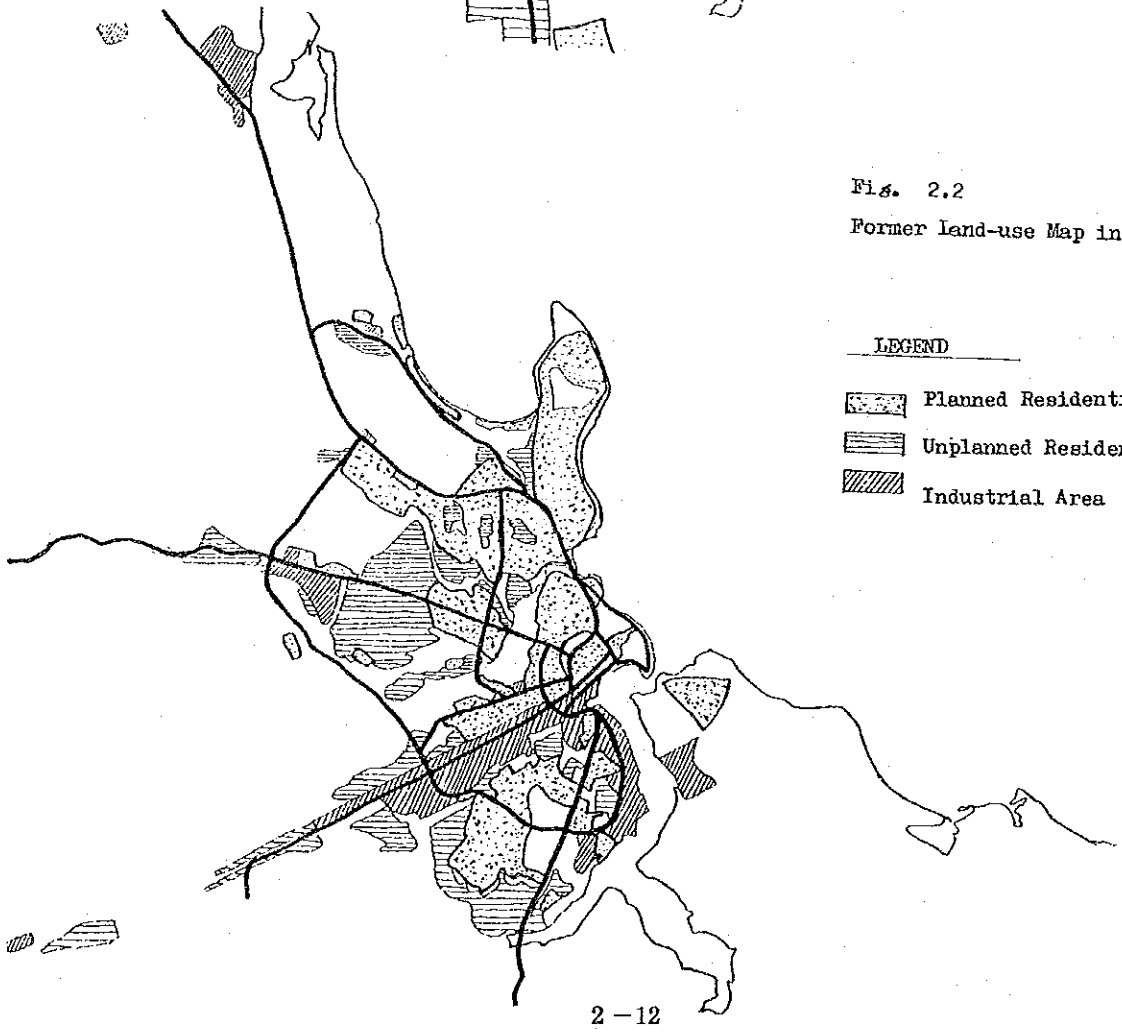


Fig. 2.2
Former Land-use Map in 1978

LEGEND

- Planned Residential Area
- Unplanned Residential Area
- Industrial Area

2.3 Transport Facilities

2.3.1 Road Transportation

Public bus transportation within the urban area of Dar es Salaam is provided by the UDA (Shirikala Usafiri Dar es Salaam Ltd.). At present the bus company KAMATA (Kampuni ya Mabasi ya Taifa) assists the UDA along a few routes.

(1) City Bus Routes and Terminals, UDA

The UDA planned to operate 59 bus routes, most of which link the various sections of the city to the city centre. The major terminals in the city centre are Kariakoo, Post, Station and Sh/Uhuru shown in Fig.2.3.

Frequent services to the city centre are provided from the major outer terminals. A number of shuttle routes lead to these terminals and passengers arriving at the main outer terminals have to change bus on their way to the city centre (The layout of each terminal is shown in Appendix 2-4).

The present routes (in 1989) are shown in Fig.2.4 and they are listed in the Table 2.7.

The KAMATA is assisting the UDA on routes number 73,49, 74,52 and Muhimbili-Kariakoo from the pool of buses. In addition the KAMATA is operating the following peri-urban routes.

Kisarawe - Kariakoo
Chanika - Kariakoo (will operate from July 1989)
Bahari Beach - Kariakoo

However, owing to lack of buses with the KAMATA the operations depend on the availability of buses.

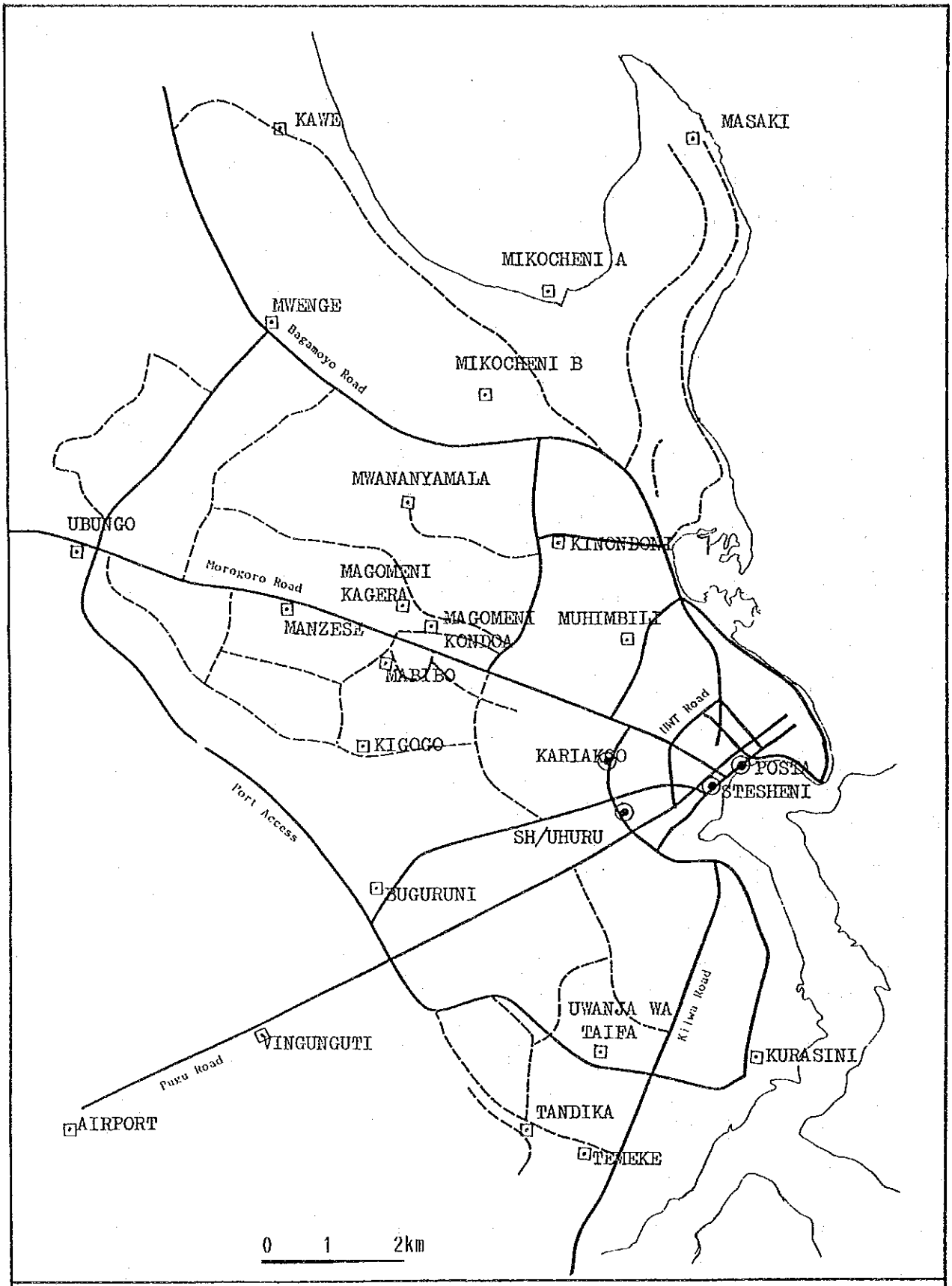


Fig. 2.3 Location Map of Bus Terminals

◉ Central Terminal

⊡ Outer Terminal

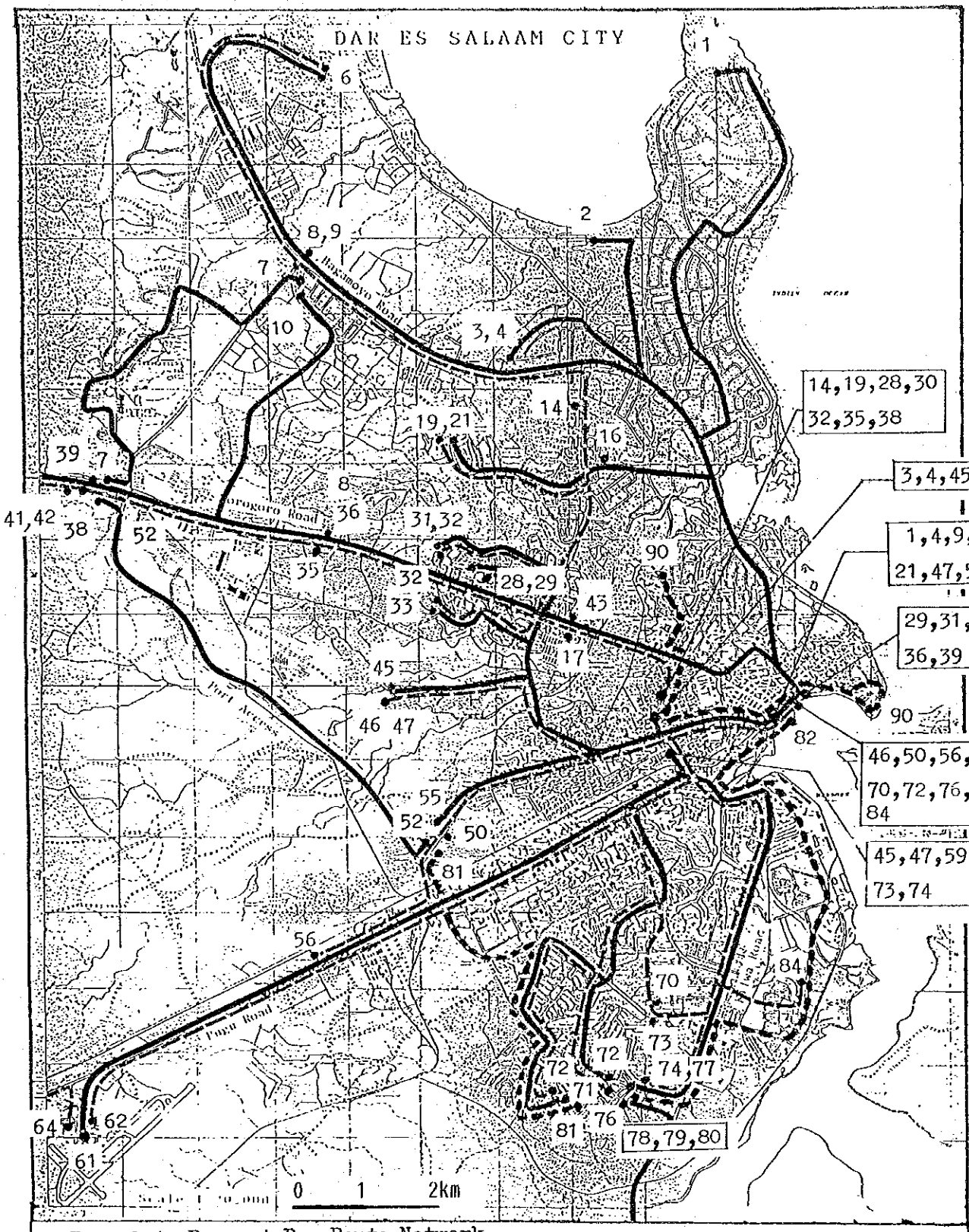


Fig. 2.4 Present Bus Route Network

Bus Routes

5 Bus Route Registrated Numbers and starting/terminating.

1,2 Point.

Table 2.7 Actual No. of buses and trips operated per day from July 1988 to February 1989

No.	Original No.	Route Name	UDA buses/Trips Ordinary	Ikarus	Mini-bus	Total	Private bus	Total buses
1	1	Masaki - Steheni	1 (16)	—	—	1 (16)	—	1
2	2	Mikorosheni - Kariakoo	1 (17)	—	—	1 (17)	—	1
3	3	Mikocheni A - Kariakoo	1 (12)	—	—	1 (12)	—	1
4	4	Mikocheni B - Stesheni	1 (21)	—	—	1 (21)	—	1
5	6	Kawe - Mwenge	1 (38)	—	—	1 (38)	—	1
6	7	Mwenge - Ubungo	1 (29)	—	—	1 (29)	—	1
7	8	Mwenge - Sinza - Manzese	1 (29)	—	—	1 (29)	9	10
8	9	Mwenge - Stesheni	2 (38)	—	—	2 (38)	—	2
9	10	Mwenge - Kariakoo	3 (36)	—	—	3 (36)	—	3
10	14	Kinindini - Kariakoo	1 (7)	—	—	1 (7)	—	1
11	16	Kinondoni - Stesheni	1 (15)	—	—	1 (15)	—	1
12	17	Bagamoyo - Mapipa	—	—	1 (24)	1 (24)	—	1
13	19	Mwananyamala- Kariakoo	3 (51)	—	—	3 (51)	9	12
14	21	Mwananyamala- Stesheni	2 (26)	—	—	2 (26)	7	9
15	28	Magomeni Konda - Kariakoo	—	—	—	—	—	—
16	29	Magomeni Konda - Posta	—	—	—	—	—	—
17	30	Karera - Kariakoo	—	—	—	—	—	—
18	31	Kgera - Posta	—	—	—	—	—	—
19	32	Kimamba - Keriakoo	—	—	—	—	—	—
20	33	Kimamba - Posta	—	—	—	—	—	—
21	34	Mabibo - Mpipa	—	—	1 (20)	1 (20)	—	1
22	35	Manzese - Kariakoo	1 (29)	1 (20)	—	2 (49)	—	2
23	36	Manzese - Posta	1 (8)	1 (14)	—	2 (22)	—	2
24	38	Ubungo - Kariakoo	2 (28)	1 (23)	—	3 (51)	37	40
25	39	Ubungo - Posta	1 (23)	1 (16)	—	2 (39)	24	26
26	40	Mbezi - Ubungo	1 (31)	—	—	1 (31)	—	1
27	41	Kimara - Ubungo	1 (29)	—	—	1 (29)	—	1
28	43	Mapipa - Buguruni	2 (46)	—	—	2 (46)	—	2
29	45	Kigogo - Sh/Uhuru	1 (37)	—	2 (20)	3 (57)	—	3
30	46	Kigogo - Posta	2 (42)	—	—	2 (42)	—	2
31	47	Kigogo - Stesheni	1 (10)	—	—	1 (10)	—	1
32	49	Buguruni - Sh/Uhuru	1 (1)	—	1 (30)	2 (31)	—	2
33	50	Buguruni - Posta	1 (24)	2 (20)	—	3 (44)	24	27

continued

No.	Original No.	Route Name	UDA buses/Trips Ordinary	Ikarus	Mini-bus	Total	Private bus	Total buses
34	51	Buguruni - Stesheni	1 (11)	—	—	1 (11)	—	1
35	52	Buguruni - Ubungo	1 (1)	1 (27)	—	2 (28)	10	12
36	55	Vigunguti - Sh/Uhuru	1 (18)	—	—	1 (18)	—	1
37	56	Vigunguti - Posta	1 (1)	1 (15)	—	2 (16)	11	13
38	59	Uw/Ndege - Sh/Uhuru	1 (18)	—	—	1 (18)	3	4
39	60	Uw/Ndege - Posta	1 (8)	2 (22)	—	3 (30)	—	3
40	61	Gongo la Mboto - Buguruni	1 (19)	—	—	1 (19)	—	1
41	62	Uw/Ndege - Sh/Uhuru	1 (1)	1 (20)	—	2 (21)	—	2
42	69	Keko - Kiliwa - Posta	—	—	—	—	—	—
43	70	Uw/Taifa - Posta	1 (19)	—	—	1 (19)	—	1
44	70	Keko - Pugu - Posta	—	—	—	—	—	—
45	70	Chang'ombe - Posta	—	—	—	—	—	—
46	71	Tandika - Sh/Uhuru	1 (5)	—	—	1 (5)	6	7
47	72	Tandika - Posta	2 (38)	—	—	2 (38)	—	2
48	73	Temeke- Chang'ombe- Sh/Uhuru	2 (46)	1 (2)	—	3 (48)	—	3
49	74	Temeke - Kiliwa - Posta	1 (25)	—	—	1 (25)	—	1
50	75	Temeke - S./Udongo - S/Uhuru	1 (28)	1 (13)	—	2 (41)	—	2
51	76	Temeke - Chang'ombe - Posta	3 (45)	—	—	3 (45)	28	31
52	77	Temeke - Kiliwa road - Posta	1 (3)	1 (17)	—	2 (20)	2	4
53	78	Temeke - S/Udongo - Posta	1 (15)	—	—	1 (15)	—	1
54	79	Mbagala - Temeke	3 (54)	—	—	3 (54)	—	3
55	80	Kongowe - Temeke	1 (27)	—	—	1 (27)	—	1
56	81	Temeke - Buguruni	2 (44)	—	—	2 (44)	—	2
57	84	Kurashini - Posta	1 (15)	—	—	1 (15)	—	1
58	89	Aga Khan - Muhimbili	—	—	1 (21)	1 (21)	—	1
59	90	Muhimbili - Kivukoni	3 (78)	—	2 (17)	5 (95)	—	5

Source: Data from UDA.

The UDA was serving its routes in 1982 by use of fleet of:
- 98 ordinary buses, each with a registered capacity of 90 passengers.
- 52 articulated Ikarus buses, each with a registered capacity of 150 passengers.
- 19 minibuses, each with a registered capacity of 31 passengers.

But on May 19,1989, the UDA was serving its routes using a nominal bus fleet of:

- 50 ordinary buses on average. (51% of 1982 ordinary bus fleet)
- 2 articulated Ikarus buses. (4% of 1982 articulated bus fleet)
- 2 minibuses. (11% of 1982 minibus fleet)

Furthermore, the planned fleet for 1988/89 was proposed as follows and total actual fleet was provided as 49% of the planned fleet required:

- 34 Benz type
- 16 Tata type
- 10 Leyland CD /84 ordinary buses.
- 24 Leyland guy
- 15 Ikarus (articulated buses)
- 12 Minibuses

111 Buses total

The ordinary and the articulated buses are allocated to a specific route. Before March 1982 the minibuses did not operate on fixed routes but were assigned to routes according to demand.

A flat fare of shs. 8.00 is charged for adults and shs. 1.00 for children upto 15 years. Seasonal tickets are sold at the main office at Kurasini. The tickets, which are valid for one month, cost shs. 900.00 for adults and shs. 130.00 for children. The card itself costs shs. 25.00(rates as of March 1982). The seasonal tickets are not valid on

other transport services and are mainly of advantage for passengers carrying out more than 5 single trips per day (often passengers changing bus to and from final destinations).

(2) Other Transport Services

Other transport services include staff buses for government departments, public parastatals, private companies and non-govermental organization.

(Private Buses.) Some companies - private or parastatal are licensed to operate between the city centre and towns nearer to Dar es Salaam. At the city centre the buses fill up, but most of passengers get off at the outer terminals of the UDA. They are charged shs. 8.00 for this trip. Very often the bus is empty when it arrives at the outskirts of Dar es Salaam, so it then turns round and picks up passangers at the UDA's bus stops and returns to the city centre. Buses operating in this illegal manner are called 'Dala-Dala Passengers in the towns outside Dar es Salaam often have difficulty in getting to Dar es Salaam, since it is much better business for the drivers to operate within the city.

There are 150 private buses operating on 3/5/ 89 but 186 private buses operating on 1/3/ 89. On average there are about 150 officially registered private buses presently.

In addition, a number of private vehicles operate as Dala-Dala's and anything from a passenger car or pick-up to a Volks-wagen minibus is used. The vehicles stop at UDA's bus stops and pick up passengers for shs. 10.00 to 20.00 (illegally).

2.3.2 Dar es Salaam Port

(1) Overview of the Port of Dar es Salaam

The port facilities of Dar es Salaam comprise 2 container berths, 9 deepsea general cargo berths, a deepsea oil products berth and a coastal and lighterage facility. The deepsea facilities are relatively modern and, with the exception of the container terminal which is constrained with respect to yard storage area, they have adequate berth length and depth and adequate support land to service the needs of modern cargo handling operations.

(2) Historical Traffic Patterns for Passenger/Cargo Handled

Appendix 2-5 summarizes passenger and cargo handled between 1978 and 1987.

Total number of passengers has been increasing and the annual increasing rate of the passenger is 12.1% from 1978 upto 1987. But total cargo handled peaked at some 4.1 million tons in 1978 had been decreased since 1978 and then recent trend of total cargo handled has been recovered and exceed the tonnage in 1978.

Therefore the annual increasing rate of cargo handled is 2.4% from 1978 to 1987.

(3) Capacity of the Port

The physical configaration of port facilities is considered to be adequate for the handling of the future traffic to the year 1992 forecasted in the interim report of the study on the capacity of the port of Dar es Salaam, January 1989.

In the event that paving of the second phase of the container yard is completed, it is pointed that the capacity of the port will be adequate to the future traffic demand in 2000.

2.3.3 Dar es Salaam International Airport

(1) Existing Physical Situation

Dar es Salaam International Airport which is located on latitude 06° 52" south and 39° 12" east at 182 feet above sea level has a 3000m long and 60m wide runway with a new passenger terminal building, mordern control tower and associated aprons and infrastructures. It has an additional crossrunway of dimensions 1000mx30m.

(2) Historical Background and Implementation Plan

By 1980, Dar es Salaam International Airport facility was found to be insufficient to cope up with the increasing traffic in terms of passengers, freight and mail.

It was therefore proposed to make extension of the facility in order to cater for the increasing traffic. The traffic forecast in the General Studies Report on Improvement and Extension of Dar es Salaam International Airport, 1980 up to the year 2000 indicates:

760,000 annual passengers handled by 1984
1,800,000 annual passengers handled by 1983
3,500,000 annual passengers handled by 2000

Freight and mail traffic were expected to show a similar increase.

Based on the traffic forecast, the phase of staged development programme were established. Phase 1 & 2 have been completed. Phase 3 is yet to be implemented subject to availability of funds and will include:

- Extension of terminal facilities for traffic of the year 2000.
- Extension of the freight facilities.
- Creation of a general aviation runway and terminal zone.

(3) Historical Trend and Forecast of Passenger and Freight Traffic

The passenger and freight traffic handled by Dar es Salaam International Airport has generally been increasing from 1978 to 1987 as shown in Appendix 2-6. Though the overall average annual increase from 1978 to 1987 is calculated to be 7.8% and the trend has been less than 7.8% between 1982 to 1987. This trend thus indicates that by the year 2000 traffic will have grown to around double the amount in 1987 i.e. around 1,500,000 passengers per year.

Considering the existing trend of average annual increase as said above, the Dar es Salaam Airport facility which has been expanded to cater for passenger traffic up to 1,800,000 passengers per year, will be adequate even at the year 2000.

(4) Recomendation on Expansion Plan After the Year 2000

At or around the year 2000 consideration has to be made for the envisaged phase 3 of the Dar es Salaam International Airport Extension Programme. The phase has to be reviewed and concrete proposals made for the improvement of the airport facilities/services to cope with the traffic demand.

2.3.4 Railway Transportation

(1) General

Dar es Salaam City is a terminal for two railway lines, namely the Central line served by Railway corporation (TRC) and Tanzania - Zambia line served by Tanzania - Zambia Railway Authority (TAZARA). The two railway lines serve to haul much passenger and freight traffic to and from the City.

(2) Tanzania Railways

The Central line passes through Central Tanzania to Kigoma & Mwanza in the west and it branches to Tanga in the east and to Moshi & Arusha in the north. Its passenger terminal in Dar es Salaam is located at the junction of Railway street and City Drive (Sokoine Drive) while its freight terminals are located at Ilala and adjacent to the Port. Its industrial lines serve the Pugu road and Ubungo industrial areas.

Usable Stock of Transport Equipment

Data of Bureau of Statistics for the years 1982 - 1986 as shown in the Table 2.10 reveal a more or less constant number of usable locomotives totally in steam and diesel engines except for 1986 when there were no usable steam engines. The freight rolling stock shows a trend of ups and downs with highest figure in 1985.

Passengers, Goods and Livestock Haulage

As shown in the Table 2.11 (from the Bureau of Statistics) the passenger volumes decreased since 1977 to 1981 and then increased from 1982 to 1985. A drop in passenger volume was recorded again in 1986. So the trend has been fluctuating. The goods haulage show a trend of little variations since 1978 to 1985 but a significant drop was recorded in 1986. The livestock haulage shows more or less

same magnitudes with low amounts in the years 1978, 1979 and 1986. The freight volumes in general have decreased since 1981.

(3) Tanzania - Zambia Railway

The Tanzania - Zambia Railway line is administered by the Tanzania - Zambia Railway Authority (TAZARA), a joint venture between Tanzanian and Zambian Governments. Its passenger terminal in Dar es Salaam is located at the junction of Port access road and Pugu road and its freight terminal at the port.

Tanzania - Zambia Railway Operating Statistics.

The data from the Bureau of Statistics (Transport Statistics 1987) shows an average of about 100 locomotives operating since 1980. However passenger rolling stock shows a tendency of slight decreases from 100 in 1980 to 95 in 1987 as shown in Table 2.12 also the freight rolling stock shows a general decrease.

However the freight arrived indicate a trend of general increase from 970,000 tons in 1987 while the passengers carried shows a sharp decrease from 1,397,000 in 1980 to 564,000 in 1983 and a general increase since then to 1,313,000 in 1987 depicting an upward trend.

Note: Zambian cargo account for more than 70% of the freight carried. So despite the downward trends in the number of locomotives and passenger rolling stock there was an upward trend in freight tonnage and passengers carried.

2.4 Existing Road Conditions

The City of Dar es Salaam has a total lenght of 1,150 km approx. of roads categorized by the surface conditions as follows:

Urban Area:		
(1)	Bituminous Roads	400 km
(2)	Gravel Roads	200 km
Suburban Area:		
(3)	Bituminous Roads	50 km
(4)	Gravel Roads	245 km
(5)	Earth Roads	245 km
	Total	1,150 km approx.

Presently most of the roads in Dar es Salaam with the exception of a few trunk and arterial roads have deteriorated to a level where normal routine maintenance is not cost effective.

These excessive damages have occurred not only on main roads and streets in the city center but also on the local roads in the industrial and residential areas, especially the roads in the following area are quite serious condition.

- Kariakoo commercial area.
- Chang'ombe industrial area.
- Ilala industrial and residential area.
- Temeke residential area.
- Magomeni commercial area.
- Mwana Nyamala residential area (Mwinjuma Road).
- Kigogo and Mburahati residential area.
- Oyster bay residential area.
- Sinza residential area.

The deterioration has been caused mainly by a long absence of proper and timely maintenance due to inadequacy of funds, small maintenance capacity due to shortage of equipment for road maintenance and rehabilitation and inappropriate policies for regular and periodic maintenance as well as

rehabilitation.

Most of the city roads have exceeded their service life and extensive overloading of trucks has resulted in premature deterioration of the paved roads causing higher operating costs and heavy maintenance costs. Government has been reviewing current axle load regulation and improvement enforcement measures with a view to increasing the axle load limit from the present 8 MT.

Proper roadside drainage system is essential for the road to function effectively, however, most of the roads with the exception of central area roads and the arterial roads with a high design standard are not equipped with proper roadside drainage systems which have accelerated the damage of pavement and shortened its service life.

Traffic and street lights in the City are mostly defective due to being old models and as no spare parts are available, and lack of funds for prompt maintenance. These devices should be overhauled and rehabilitated efficiently so as to reduce the traffic accidents and to keep the smooth traffic flow.

Due to higher rate of City expansion as well as recent acute increase in vehicle traffic demand in Dar es Salaam accompanying the recovery of economic situation in Tanzania, there seem to be a high level of imbalance between the high rate of deterioration of the City roads and the capability of City Council to render the required services to the roads. The deterioration will persist year after year unless suitable urgent measures are taken.

CHAPTER 3 TRAFFIC SURVEY AND ANALYSIS

3.1 Method of Traffic Survey

3.1.1 Classification and Scope of Traffic Survey

In order to understand traffic problems on city roads for the purpose of establishing a expedient road network in the future, it is necessary to clarify overall traffic movement in the study area. Based on the above purpose, the following traffic surveys have been conducted:

Mode of Traffic	Type of Survey	Objective
Car, Truck and bus	O-D Survey at roadside stations	Preparation of O-D table and traffic analysis
	Traffic Count Survey	Supplementary for completing of O-D table and analyze traffic movement.
	- 1 Week Traffic Count: (6:00 - 18:00)	Calculation of one week variation factor for estimation of ADT.
	- 24 hr Traffic Count: (6:00 - 6:00)	Calculation of the daily/day-time ratio for estimation of ADT.
	- 12 hr Traffic Count: (6:00 - 18:00)	Understanding the exsiting traffic movement in the study area
	Running speed survey	Evaluation of road network systems, traffic analysis and benefit calculation

3.1.2 Flow Chart of Traffic Analysis

Fig.3.1 shows the analysis procedure of existing traffic movements taken from the traffic survey and the estimation methodology of future traffic volume on the future road network.

3.2 Preparation of Traffic Survey

3.2.1 Traffic Zoning of the Study Area

In order to analyze the existing traffic patterns over the study area, such as the relation between city-center and suburban areas, it is necessary to divide the study area into traffic zones. For the estimation of future traffic volume, it is necessary to clarify the availability of various socio-economic factors such as population, employment, production and development plan, etc. by traffic zones.

Taking the above factors into consideration, certain criteria were established for dividing the study area into traffic zones as follows:

a) Zones in Dar es Salaam should be based fundamentally on zoning taken from the Tanzania Population Census in 1988.
b) Each zone will basically have a population of approximately 40,000-50,000 people.
c) Some zones will be combined with others having the same land-use pattern.
d) Zoning for the surrounding area of the Dar es Salaam region follows the administrative district zones.
e) Zoning for outside of the surrounding area and rural of Tanzania is a combination of some regions.

In conclusion, 43 zones were established in total. The number of zones confirmed in Dar es Salaam totalled 34 while 9 zones composed outside Dar es Salaam. These are as shown in Fig.3.2. and Appendix 3-1.

Fig. 3.1 Frow Chart on Traffic Analysis

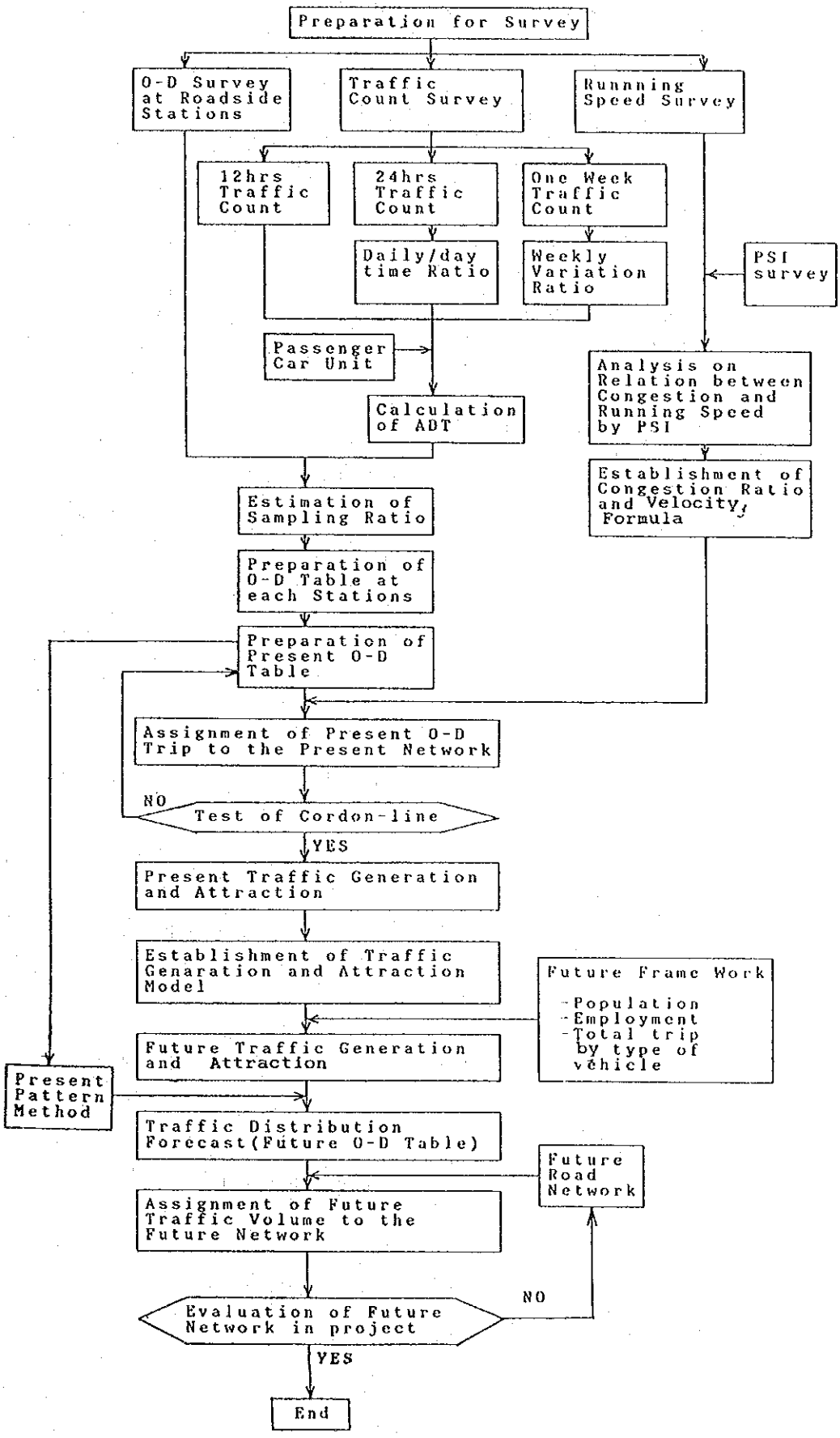
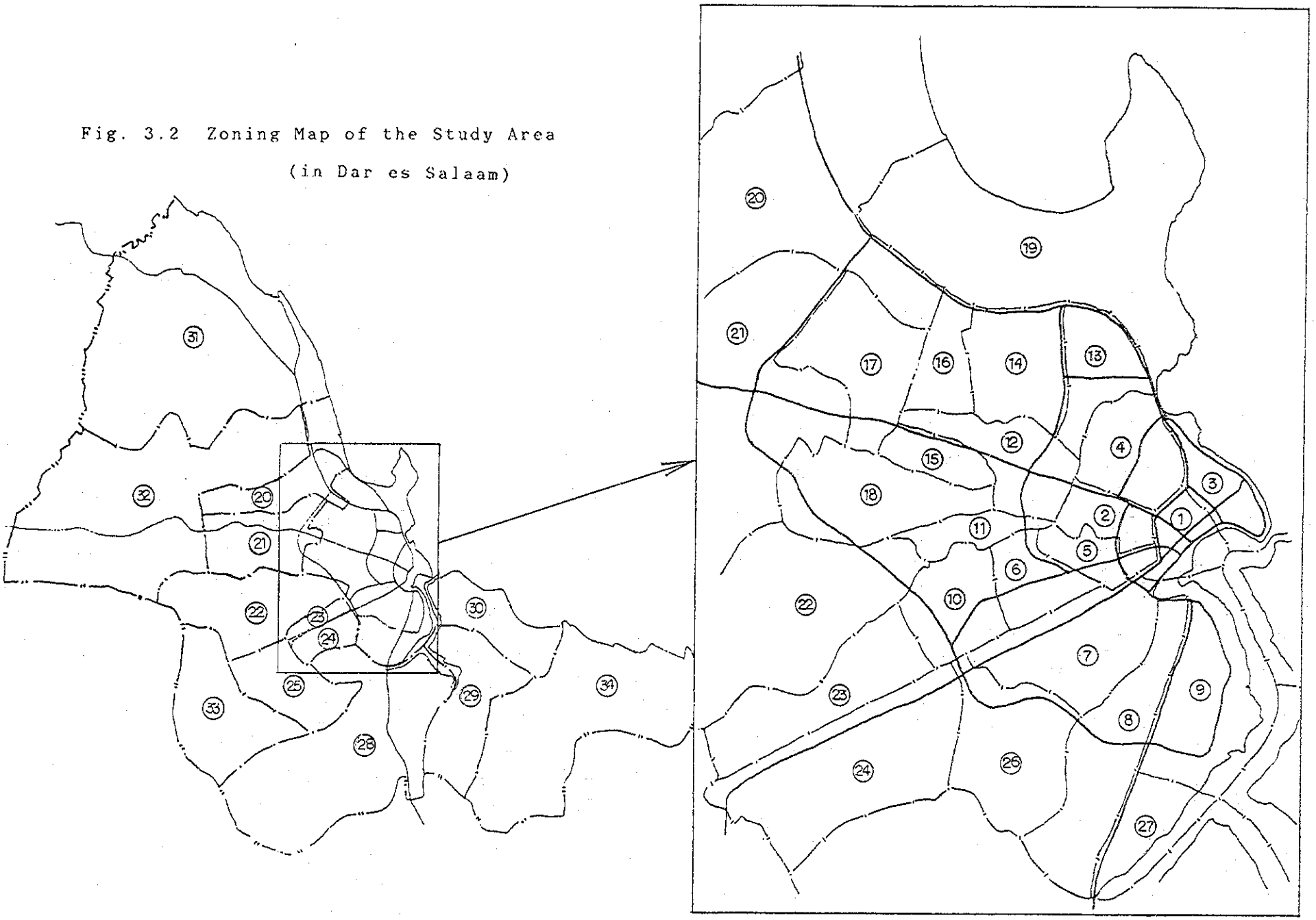


Fig. 3.2 Zoning Map of the Study Area
(in Dar es Salaam)



3.2.2 Survey Location and Duration

Survey stations were selected as illustrated in Fig.3.3 after considering the objective roads for study and zoning. The implementation schedule for Traffic Survey is planned as shown in Appendix 3-2 and an assignment schedule of each stations has been established as shown in Appendix 3-3.

A traffic count survey was conducted at 39 stations consisting of 11 stations for O-D Survey, 28 stations on arterial roads and 11 stations on collector roads. A detail -ed method of this survey is shown in Appendix 3-4.

The one-week Traffic Count Survey and the 24 hr Traffic Count Survey were conducted on Morogoro Road which is a typi -cal radial road and it's traffic is assumed to represent the weekly and hourly variation of traffic demand in the urban area.

An O-D survey at roadside stations was conducted at 11 stations on the two cordon-lines: the inner cordon-line surr -ounds the city-center while the outer cordon-line surrounds the urban area. The survey was conducted during 6 weekdays from May 10th to May 17th after trainning traffic police off -icers and students at the university and technical college. A detailed method of O-D survey is shown in Appendix 3-7.

3.2.3 Type of Vehicle

The classification of vehicle types for the Traffic Survey was divided into five types of vehicles as shown in Table 3.1. This was done considering the estimation of present and future O-D tables compiled by vehicle type, ADT calculation and the analysis of the distribution of heavy goods vehicles.

As motorcycles and bicycles are few in Dar es Salaam, they were assumed to have little influence on traffic move- ment and have been excluded from the Traffic Survey.

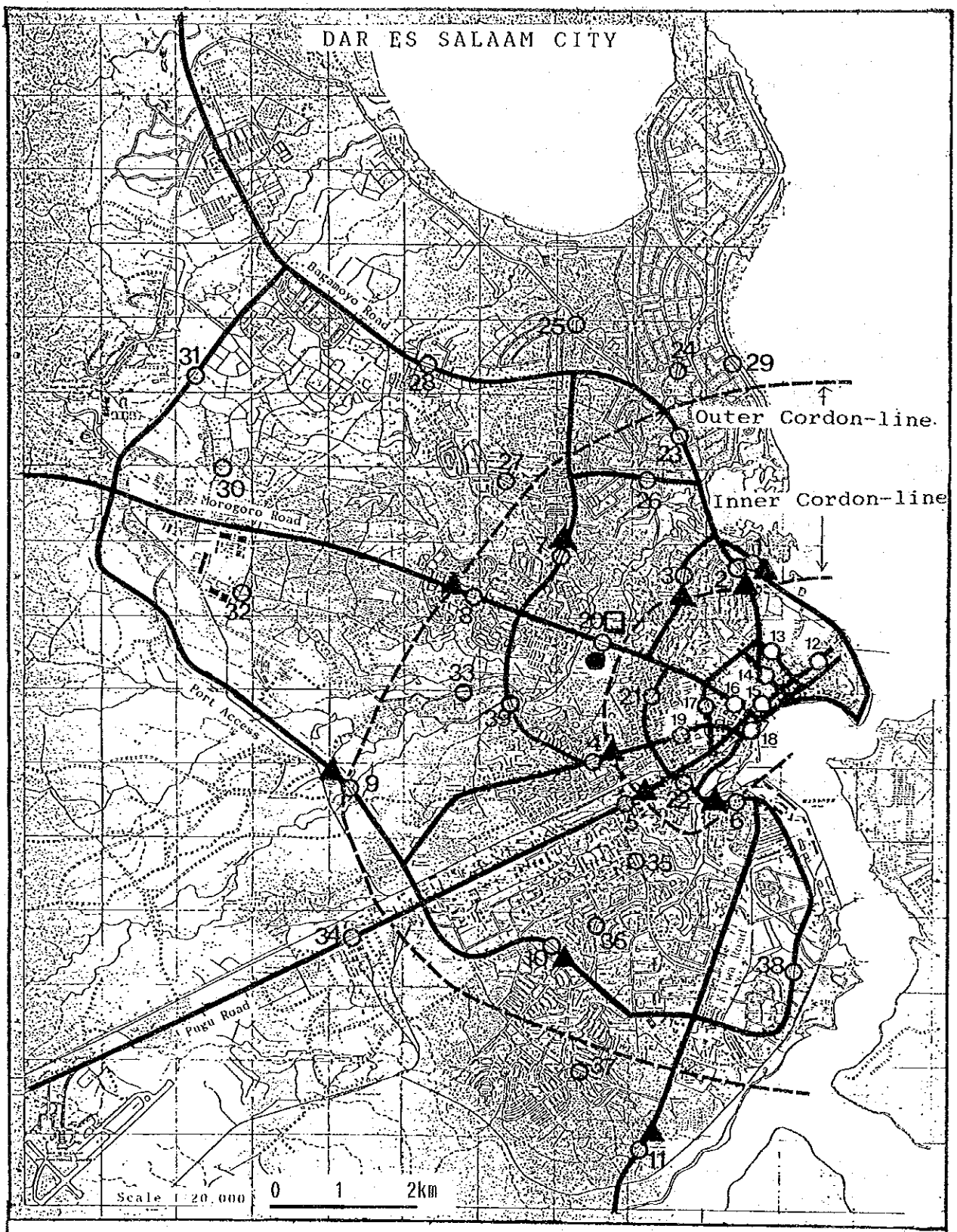


Fig 3.3 Location Map of Traffic Survey Stations

▲ OD. Survey Point (11 points)
□ 1 Week Traffic Count (1 point)
● 24hr Traffic Count (1 point)
○ 12hr Traffic Count (39 points)