

CHAPTER 11 SHORT-TERM DEVELOPMENT PLAN AND IMPLEMENTATION SCHEDULE

11.1 Short-term Development Plan

The basic attitude for formulating the Short-term Development Plan is to consider minimum level of improvement on transportation infrastructure and traffic management measures so as to extract maximum services from the existing facilities. In addition, when formulating the Short-term Development Plan considerations were given to improve transport services for the public and traffic safety. With these considerations, the following major criteria were introduced for a confirmation of urgency of proposed projects in the Short-term Development Plan:

- Improvement of bottlenecks on urban roads
- Improvement of the transportation poor

(1) Short-term Road Development Plan

The Study Team formulated the Short-term Road Development Plan in which the road network as shown in Fig. 11.1 will be constituted. The applied concept of road development can be outlined as follows:

- Widening of Arterial Roads in the City Center for the Formation of Inner Ring Road
- Widening of Middle Ring Road with Construction of Missing Link
- Widening of Three Radial Trunk Roads from 2 to 4 Lanes
- Strengthening of Road Network in Kigamboni with Improvement of Kigamboni Ferry Port
- Construction of Outer Ring Road
- Strengthening of Road Network along Pugu Road
- Construction and Improvement of Road Network inside Nelson Mandela Road
- Reconstruction of Bridges on Trunk Roads
- Improvement of Important Road in Rural Areas

(2) Short-term Public Transport Development Plan

Regarding the Short-term Development Plan for public transport, the following plans are recommended to be implemented for an early solution of the existing issues in public transport system:

- Construction of West-bound Long-distance Bus Terminal
- Shuttle Bus Operation (West Bound Long-distance Bus Terminal)
- Strengthening of Junctional Function (Major and Small Bus Terminal)
- Construction of Two City Bus Terminals (Sokoine Drive and Kariakoo)
- Construction of Local Bus Stations (Road Side Type and Terminal Type)

(3) Short-term Traffic Management Development Plan

Regarding the proposed traffic management plan, the following are recommended to be implemented in the short-term for the realization of streamlined urban traffic:

- Construction of Public Parking Building (1 No.)
- Traffic Regulation in the City Center
- Introduction of Pedestrian Mall and Construction of Two Pedestrian Bridges
- Improvement of Intersections with Installation of Traffic Signals and Pedestrian Signals

11.2 Implementation Schedule

The implementation schedule prepared by the Study Team is summarized as in Table 11.1. The following factors have been taken into account:

(1) Short-term Plan

- Time requirement for subsequent services including feasibility study and detailed design required for the implementation of the Project
- Necessary arrangement for land/house acquisition and compensation to be performed by the Government of Tanzania
- Balance of the disbursement schedule of funds required for the implementation of the Project

(2) Long-term Plan

- Establishment of road network for well-balanced urban development
- Engineering requirement from the viewpoint of traffic demands
- Homogeneous development of Dar es Salaam

The recommended road network to be implemented in the Long-term is illustrated in Fig. 11.2. The implementation programme in Short-term and Long-term for road, public transport and traffic management development are presented in Table 11.2 and Table 11.3, respectively.

Preliminary economic evaluation has been conducted on the basis of the investment program to confirm the economic viability of the proposed road development plan as recommended in the Master Plan.

As a result of the economic evaluation, Internal Rate of Return (IRR) came up with 15.7% and the economic viability of the proposed Road Development Master Plan has been confirmed.

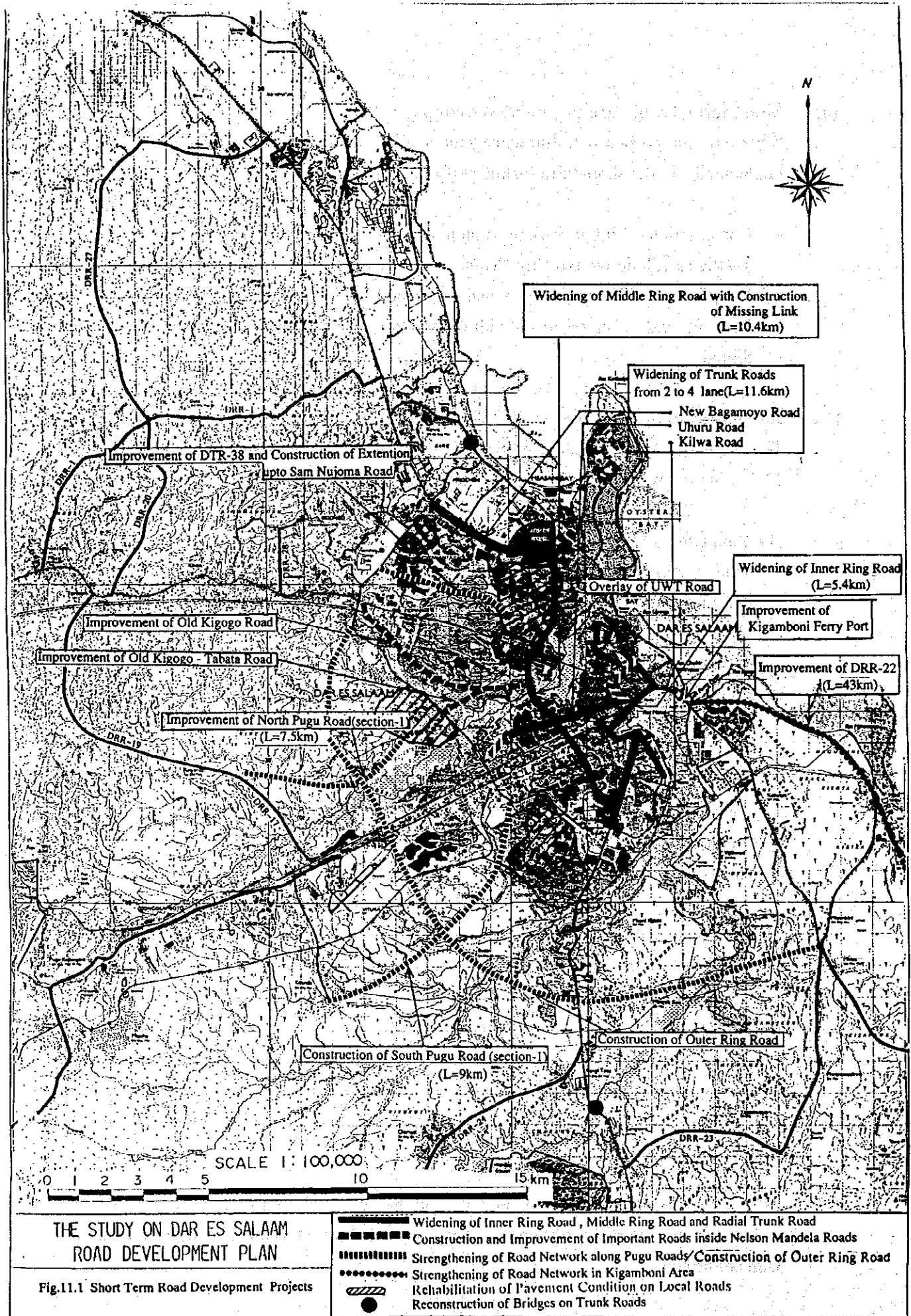
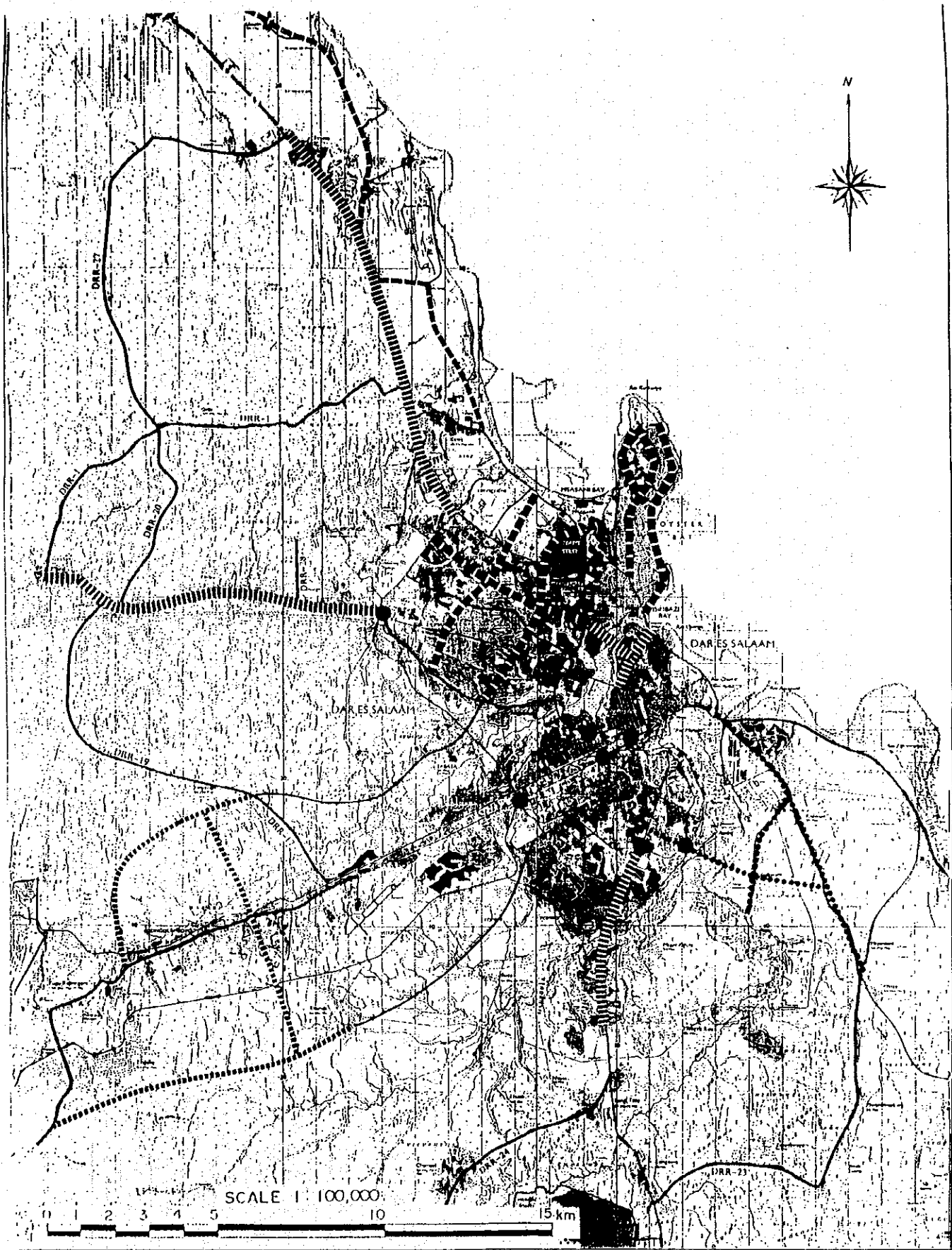


Table 11.1(1) Concept of Implementation Schedule for Road Development

Road Development Plan and Projects	Project Length	Short Term Plan (- 1999)	Long Term Plan (2000 - 2010)
1. Widening of Arterial Roads in City Center	5.67		
(1) Widening of Inner Ring Road (Ohio(DTR-17), Kivukoni Front(DTR-32), Sokoine Drive(DTR-8), Gerezani(DTR-16) and Bandari Roads (DTR-24))	5.43	0	
(2) Construction of New Access between UWT and Gerezani Road	0.24		0
2. Widening of Middle Ring Road with Construction of Missing Link	10.35	0	
(Widening of Morocco (DTR-7), New Kigogo (DTR-31) and Chang'ombe Road(DTR-21) and Construction of Missing Link between New Kigogo and Chang'ombe Road)			
3. Widening of Trunk Roads from 2 to 4 lane	48.60		
(1) Widening of New Bagamoyo Road(DTR-5) beyond Morocco Road Junction upto Sam Nujoma Road Junction	4.40	0	
(2) Widening of New Bagamoyo Road from Sam Nujoma upto Wazo Hill	12.60		0
(3) Widening of Sam Nujoma Road(DTR-5)	3.90		0
(4) Widening of Morogoro Road (DTR-3) from Ubugo upto Mbezi	11.00		0
(5) Widening of Uhuru Road(DTR-9) from Gerezani upto 4 lane section	4.00	0	
(6) Widening of United Nations Road (DTR-13)	2.00		0
(7) Widening of Kilwa Road(DTR-4) from Bandari Road Junction upto Nelson Mandela Road	3.20	0	
(8) Construction of New Access between United Nations and Morocco Road	1.90		0
(9) Widening of Kilwa Road (DTR-4) beyond Nelson Mandela Road upto Outer Ring Road	5.60		0
	181.50		
4. Strengthening of Road Network in Kigamboni Area with Construction of Bridge across Harbor			
(1) Improvement of Kigamboni Ferry Port		0	
(2) Construction of Harbor Bridge with Access Road	2.80		0
(3) Construction of Kurasini Bridge with Access Road	5.30		0
(4) Improvement and Rehabilitation of DRR-22 from Kivukoni upto Mnazi	43.00	0	
(5) Improvement of DRR-23 from Kongwezi upto Mjimweina	5.00		0
(6) Improvement of DRR-14 from Kivukoni upto Vijibweni	6.50		0
(7) Improvement of DRR-29 from Tungi upto Kibada	5.90		0
(8) Rehabilitation of DRR-2 from Mwongozo upto Gomvu	12.50		0
(9) Rehabilitation of DRR-3 from Chekeniwasonga upto Buyuni	43.10		0
(10) Rehabilitation of DRR-8 from Kimbiji upto Chekeniwasonga	11.50		0
(11) Rehabilitation of DRR-12 from Kimbiji upto Songani	18.00		0
(12) Rehabilitation of 1 lane section of DRR-22	13.40		0
(13) Rehabilitation of DRR-30 from Kibada upto Gezauloc	14.50		0
5. Construction of Outer Ring Road	23.00	0	
6. Strengthening of Road Network along Pugu Road			
(1) Construction of South Pugu Road(section-1)	9.00	0	
(2) Construction of South Pugu Road(section-2)	9.50		0
(3) Improvement of North Pugu Road (section-1)	7.50	0	
(4) Construction of North Pugu Road (section-2)	7.50		0
(5) Construction of North south Access	7.70		0
7. Construction and Improvement of Trunk Roads and Collector Roads			
(1) Overlay of UWT Road	2.00	0	
(2) Overlay of existing 4 lane section of Uhuru Road	1.20	0	
(3) Improvement of Old Kigogo Road(DTR-29)	6.50	0	
(4) Improvement of Old Kigogo - Tabata Road	1.50	0	
(5) Improvement of DTR-20 from Morogoro Road upto NIT	1.40		0
(6) Improvement of New Sionza Road	3.80		0
(7) Improvement of Kagera Road (DTR-26)	2.40		0
(8) Improvement and Construction of Kagera/New Bagamoyo Road	2.60		0
(9) Improvement of DTR-25 between Old Kigogo/Nelson Mandela Road	1.00		0
(10) Improvement of Mikochehi Access(DTR-36)	1.30		0
(11) Improvement of DTR-38 and Construction of Extension upto Sam Nujoma Road	6.00	0	
(12) Improvement of DTR-39 and Construction of Extension upto Sam Nujoma Road	4.70		0
(13) Improvement of Extension of Old Bagamoyo Road to North	6.70		0
(14) Improvement of Tembe/Mbagala(DTR-28)	4.70		0
(15) Overlay of Kenyatta/Tore Drive(DTR-18)	7.60		0
(16) Improvement and Overlay of Chole Road(DTR-35)	3.00		0
(17) Improvement and Overlay of Haile Selassie(DTR-27)	5.40		0

Table 11.1(2) Concept of Implementation Schedule for Road Development

Road Development Plan and Projects	Project Length	Short Term Plan (- 1999)	Long Term Plan (2000 - 2010)
8. Rehabilitation of Pavement Condition on Local Roads			
(1) Improvement of Local Roads in Temcke Area	13.900	0	
(2) Improvement of Local Roads in Ilala Area	10.300	0	
(3) Improvement of Local Roads in Tabata Area	9.200	0	
(4) Improvement of Local Roads in Sinza Area	9.200	0	
(5) Improvement of Local Roads in Mwinjijuma Area	17.200	0	
9. Reconstruction of Bridge on Trunk Road	0.190	0	
10. Construction of Grade Separated Intersection at major Trunk Road			
(1) Construction of Intersection between Middle Ring Road and Pugu Road	1 No.		0
(2) Construction of Intersection between Middle Ring Road and Uhuru Road	1 No.		0
(3) Construction of Intersection between Middle Ring Road and Morogoro Road	1 No.		0
(4) Construction of Intersection between Nelson Mandela Road and Pugu Road	1 No.		0
(5) Construction of Intersection between Nelson Mandela Road and Morogoro Road	1 No.		0
(6) Construction of Intersection between Nelson Mandela Road and Kilwa Road	1 No.		0
(7) Construction of Intersection between Msimbazi Road and Pugu Road	1 No.		0
(8) Construction of Intersection between Middle Ring Road and Nelson Mandela Road	1 No.		0
(9) Construction of Intersection between Middle Ring Road and Pugu Road	1 No.		0
11. Improvement of Trunk and District Road in Rural Area			
(1) Improvement and Rehabilitation of New Bagamoyo Road(DTR-5) outside Wazo-Hill	20.50	0	
(2) Overlay of Morogoro Road(DTR-3) outside Mbezi	13.60		0
(3) Rehabilitation of Kawe/Mbezi Road(DRR-1)	16.00		0
(4) Rehabilitation of Pugu/Msongolai Road(DRR-4)	20.00		0
(5) Rehabilitation of Kawembe/Kisosa(DRR-6)	13.90		0
(6) Rehabilitation of Kibamba/Magoc Mpiji Road(DRR-7)	9.00		0
(7) Rehabilitation of Mikuwambe/Gezauloe Road(DRR-9)	20.00		0
(8) Improvement of Kunduchi/Boko Road(DRR-10)	11.40		0
(9) Rehabilitation of Msongola/Byuni Road(DRR-11)	16.00		0
(10) Rehabilitation of Pugu/Kajigueni Road(DRR-13)	8.30		0
(11) Rehabilitation of Bunju/Mpiji Road(DRR-15)	24.10		0
(12) Rehabilitation of DIA-G/Mboto Road(DRR-16)	7.20		0
(13) Rehabilitation of Pugu/Tabata Road(DRR-17)	5.00		0
(14) Rehabilitation of Mbezi/Kwembe Road(DRR-18)	8.00		0
(15) Rehabilitation of Temboni/Kinyerezi Road(DRR-19)	9.00		0
(16) Rehabilitation of Temboni/Goba Road(DRR-20)	5.70		0
(17) Rehabilitation of Goba/Mpiji Road(DRR-21)	8.30		0
(18) Rehabilitation of Kongowc/Mjimwema Road(DRR-23)	12.60		0
(19) Rehabilitation of Pugu/Mbagala Road(DRR-24)	46.40		0
(20) Rehabilitation of Mbezi/Kwembe Road(DRR-25)	4.50		0
(21) Rehabilitation of Morogoro/Kitviai Road(DRR-26)	2.30		0
(22) Rehabilitation of Wazo Hill/Goba Road(DRR-27)	11.30		0
(23) Rehabilitation of Kibo/Msewe Road(DRR-28)	1.50		0



THE STUDY ON DAR ES SALAAM
ROAD DEVELOPMENT PLAN

Fig. 11.2 Long-term Road
Development Projects

- Widening of Trunk Roads from 2 to 4 lane
- Strengthening of Road Network in Kigamboni Area with Construction of Bridge Access Harbours
- Strengthening of Road Network along Pueu Road
- Construction and Improvement of Trunk Roads and Collector Roads
- Construction of Grade Separated Intersection
- Improvement of Trunk and District Road in Rural Area

Table 11.2(1) Proposed Implementation Programme of Short Term Development Plan in Dar es Salaam

(Unit: Million Tsh.)

Short-term Development Plan and Projects	1995		1996		1997		1998		1999		Remarks Total
	Project Length(km)	Construction	Land/House	Construction	Land/House	Construction	Land/House	Construction	Land/House		
Category A : Road Development Plan											
AS-1 Widening of Arterial Roads in City Center	5.43										0
(1) Widening of Inner Ring Road	5.43	3,910									3,910
(Other DTR-17, Kivukoni Front(DTR-32), Solokine Drive(DTR-8), Gerezani(DTR-16) and Bahari Road (DTR-24))											0
AS-2. Widening of Middle Ring Road with Construction of Missing Link	10.35			4,590	20	3,200					7,810
(Widening of Morocco (DTR-7), New Kigogo (DTR-31) and Cung umbu Road(DTR-21) and Construction of Missing Link between new Kigogo and Chang umbu Road)											0
AS-3. Widening of Trunk Roads from 2 to 4 lane	11.60										0
(1) Widening of New Bagamoyo Road(DTR-5) from Morocco Road Junction up to Sami Njoroni Road Junction	4.40							2,000			4,000
(2) Widening of Uhuru Road(DTR-9) from Gerezani upto 4 lane section	4.00							2,990		400	2,990
(3) Widening of Kijwa Road(DTR-4) from Bahari Road Junction up to Nelson Mandela Road	3.20			1,280	80	900					2,260
AS-4. Strengthening of Road Network in Kigamboni Area including Construction of Bridge Access Harbor	43.00										0
(1) Improvement of Kigamboni Ferry Port	700			560							1,260
(2) Improvement and Rehabilitation of DTR-22 from Kivukoni upto Mfazi	43.00					2,580		2,580			7,740
AS-5. Construction of Outer Ring Road	23.00										0
AS-6. Strengthening of Road Network along Pugu Road	16.50										0
(1) Construction of South Pugu Road(section-1)	9.00							2,900	140	1,450	4,490
(2) Improvement of North Pugu Road (section-1)	7.50							1,950	110	980	3,040
AS-7. Construction and Improvement of Road Network inside Nelson Mandela Road	17.30										0
(1) Overlay of UWT Road	2.00	340									340
(2) Overlay of existing 4 lane section of Uhuru Road	1.20									220	220
(3) Improvement of Old Kigogo Road(DTR-29)	6.50	1,600		1,070							2,670
(4) Improvement of Old Kigogo - Tabata Road	1.50	400		220							620
(5) Improvement of DTR-33 and Construction of Extension up to Sami Njoroni Road	6.10	1,450	20	1,090							2,550
AS-8. Rehabilitation of Pavement Condition on Local Roads	59.8										0
(1) Improvement of Local Roads in Tembe Area	13.9	2,090									2,090
(2) Improvement of Local Roads in Ilala Area	10.3			1,550							1,550
(3) Improvement of Local Roads in Tabata Area	9.2								1,390		1,390
(4) Improvement of Local Roads in Sinza Area	9.2			1,380							1,380
(5) Improvement of Local Roads in Mwanjijuma Area	17.2									2,580	2,580
Subtotal(I)		10,510	20	10,190	100	15,180	180	14,790	140	13,220	62,630

Table 11.2(2). Proposed Implementation Programme of Short Term Development Plan in Dar es Salaam

(Unit: Million Tsh.)

Short-term Development Plan and Projects	Project Length	1.995		1.996		1.997		1.998		1.999		Remarks (Total)
		Construction	Land/House	Construction	Land/House	Construction	Land/House	Construction	Land/House	Construction	Land/House	
AS-9. Reconstruction of Bridges on Trunk Road	0.190									377		655
AS-10. Improvement of Important Road in Rural Area	14.1											0
(1) Improvement and Rehabilitation of New Bagamoyo Road (DTR-9) outside Wazo-Hill	14.1							1,270		1,270		2,540
AS-11. Strengthening of Maintenance Capability												0
Category B: Public Transport Development Plan												0
BS-1. Improvement of Long distance Bus Services												0
(1) Construction of West-bound Long-distance Bus Terminal		800										800
(2) Shuttle Bus Operation (West-bound Long-distance Bus Terminal)		60										60
BS-2. Improvement of City Bus Services												0
(1) Construction of City Bus Terminals		60										60
(2) Improvement of Construction of Local Bus Stations		105										105
(3) Strengthening of Junction Function (Major)		70										70
Category C: Traffic Management Plan												0
CS-1. Traffic Regulation in City Center												0
CS-2. Reduction of Roadside Parking												0
(1) Construction of Parking Building in City Center 1 Nos				1,800		1,200						3,000
CS-3. Streamlining of Pedestrian Flow												0
(1) Introduction of Pedestrian Mall		88										88
(2) Construction of Two Pedestrian Bridges				175								175
CS-4. Improvement of Bottleneck Point												0
(1) Installation of new Traffic Signal		6										6
(2) Improvement of Existing Traffic Signal		6										6
(3) Restructuring of Kenyatta to -bus grade intersection		20										20
(4) Major Improvement of air-grade intersection		189										189
(5) Minor Improvement of air-grade intersection		6										6
Subtotal(2)		1,410		1,975		1,200		1,598		1,597		7,780
Total		11,920		12,105		14,380		16,348		14,817		70,410

(Exchange Rate: 1.00US\$ = Tshs.490 = K110)

Table 11.3(1) Proposed Implementation Programme of Long-Term Development Plan in Dar es Salaam

(Unit : Million Tshs.)

Road Development Plan and Projects	Project Length	Long Term Plan(2000-2011)		Total
		Construction	Land/House	
AL-1. Widening of Arterial Roads in City Center				
(1) Construction of New Access between UWT and Gereza Road	0.24	140	20	160
AL-2. Widening of Trunk Roads from 2 to 4 lane	37.00			
(1) Widening of New Bagamoyo Road from Sam Nujoma upto Wazo Hill	12.60	9,040		9,040
(2) Widening of Sam Nujoma Road(DTR-5)	3.90	3,140		3,140
(3) Widening of Morogoro Road (DTR-3) from Ubungu upto Mbezi	11.00	10,010	280	10,290
(4) Widening of United Nations Road (DTR-13)	2.00	1,360	50	1,410
(5) Construction of New Access between United Nations and Morocco Road	1.90	2,900	50	2,950
(6) Widening of Kilwa Road (DTR-4) from Nelson Mandela Road upto	5.60	3,950	30	3,980
AL-3. Strengthening of Road Network in Kigamboni Area including Construction of Bridge Access Harbor	130.50			
(1) Construction of Harbor Bridge with Access Road	2.80	25,470	280	25,750
(2) Construction of Kirsini Bridge with Access Road	5.30	18,210	130	18,340
(3) Improvement of DRR-23 from Kongwei upto Mjimwena	5.00	2,050		2,050
(4) Improvement of DRR-14 from Kivukoni upto Vijibweni	6.50	2,670		2,670
(5) Improvement of DRR-29 from Tunai upto Kibada	5.90	2,470		2,470
(6) Rehabilitation of DRR-2 from Mwongozo upto Gonru	12.50	750		750
(7) Rehabilitation of DRR-3 from Chekeniwasonga upto Buyuni	43.10	2,590		2,590
(8) Rehabilitation of DRR-8 from Kimbiji upto Chekeniwasonga	11.50	690		690
(9) Rehabilitation of DRR-12 from Kimbiji upto Songani	18.00	1,080		1,080
(10) Rehabilitation of 1 lane section of DRR-22	13.40	800		800
(11) Rehabilitation of DRR-30 from Kibada upto Cezauloe	14.50	870		870
AL-4. Strengthening of Road Network along Pugu Road	24.20			
(1) Construction of South Pugu Road(section-2)	9.00	3,710	140	3,850
(2) Construction of North Pugu Road (section-2)	7.50	3,080		3,080
(3) Construction of North-south Access	7.70	3,410	120	3,530
AL-5. Construction and Improvement of Trunk Roads and Collector Roads	45.60			
(1) Improvement of DTR-20 from Morogoro Road upto NIT	1.40	570		570
(2) Improvement of New Sionza Road	3.80	1,700		1,700
(3) Improvement of Kagera Road (DTR-26)	2.40	1,110		1,110
(4) Improvement and Construction of Kagera/New Bagamoyo Road	3.60	1,040	20	1,060
(5) Improvement of DTR-25 between Old Kigogo/Nelson Mandela Road	1.00	410		410
(6) Improvement of Mikocheni Access(DTR-36)	1.30	530		530
(7) Improvement of DTR-39 and Construction of Extension upto Sam Nujoma Road	4.70	1,900	20	1,920
(8) Improvement of Extension of Old Bagamoyo Road to North	6.70	2,750		2,750
(9) Improvement of Feneke/Mbagala(DTR-28)	4.70	1,930		1,930
(10) Overlay of Kenyatta/Toure Drive(DTR-18)	7.60	680		680
(11) Improvement and Overlay of Chole Road(DTR-35)	3.00	1,080		1,080
(12) Improvement and Overlay of Haile Selassie(DTR-27)	5.40	1,350		1,350
Subtotal(1)		113,390	1,140	114,530

Table 11.3(2) Proposed Implementation Programme of Long-Term Development Plan in Dar es Salaam

(Unit: Million Tshs.)

Road Development Plan and Projects	Project Length	Long Term Plan(2000-2011)		Total
		Construction	Land/House	
AL-6. Construction of Grade Separated Intersection at Major Trunk Roads	8 No.			
(1) Construction of Intersection between Middle Ring Road and Pugu Road	1 No.	1,610		1,610
(2) Construction of Intersection between Middle Ring Road and Uhuru Road	1 No.	1,610		1,610
(3) Construction of Intersection between Middle Ring Road and Morogoro Road	1 No.	1,610		1,610
(4) Construction of Intersection between Nelson Mandela Road and Pugu Road	1 No.	1,610		1,610
(5) Construction of Intersection between Nelson Mandela Road and Morogoro Road	1 No.	1,610		1,610
(6) Construction of Intersection between Nelson Mandela Road and Kilwa Road	1 No.	1,610		1,610
(7) Construction of Intersection between Msimbazi Road and Pugu Road	1 No.	1,610		1,610
(8) Construction of Intersection between Middle Ring Road and Nelson Mandela Road	1 No.	1,610		1,610
AL-7. Improvement of Trunk and District Road in Rural Area	280.50			
(1) Overlay of Morogoro Road(DTR-3) outside Mbezi	13.60	1,230		1,230
(2) Rehabilitation of Kawe/Mbezi Road(DRR-1)	16.00	960		960
(3) Rehabilitation of Pugu/Msongolai Road(DRR-4)	20.00	1,200		1,200
(4) Rehabilitation of Bunju-Mbeweni(DRR-5)/Msongolai Road(DRR-5)	6.40	1,730		1,730
(5) Rehabilitation of Kawembe/Kisosa(DRR-6)	13.90	830		830
(6) Rehabilitation of Kibamba/Mageo Mpiji Road(DRR-7)	9.00	540		540
(7) Rehabilitation of Mikuwambe/Gezauloe Road(DRR-9)	20.00	1,200		1,200
(8) Improvement of Kunduchi/Boko Road(DRR-10)	11.40	2,050		2,050
(9) Rehabilitation of Msongola/Byuni Road(DRR-11)	16.00	960		960
(10) Rehabilitation of Pugu/Kaijigueni Road(DRR-13)	8.30	500		500
(11) Rehabilitation of Bunju/Mpiji Road(DRR-15)	24.10	1,450		1,450
(12) Rehabilitation of DIA/GMbofo Road(DRR-16)	7.20	1,300		1,300
(13) Rehabilitation of Pugu/Tabata Road(DRR-17)	5.00	300		300
(14) Rehabilitation of Mbezi/Kwenbe Road(DRR-18)	8.00	480		480
(15) Rehabilitation of Temboni/Kinyerezi Road(DRR-19)	9.00	540		540
(16) Rehabilitation of Temboni/Coba Road(DRR-20)	5.70	340		340
(17) Rehabilitation of Coba/Mpiji Road(DRR-21)	8.30	500		500
(18) Rehabilitation of Kongowe/Mjimwema Road(DRR-23)	12.60	2,270		2,270
(19) Rehabilitation of Pugu/Mbagala Road(DRR-24)	46.40	8,350		8,350
(20) Rehabilitation of Mbezi/Kwenbe Road(DRR-25)	4.50	270		270
(21) Rehabilitation of Morogoro/Kilvial Road(DRR-26)	2.30	140		140
(22) Rehabilitation of Wazo Hill/Coba Road(DRR-27)	11.30	680		680
(23) Rehabilitation of Kibo/Msewe Road(DRR-28)	1.5	90		90
Category B : Public Transport Development Plan				
BL-1. Improvement of Long-distance Bus Services				
(1) Improvement of West-bound Long-distance Bus Terminal		450		450
(2) Shuttle Bus Operation (West-bound Long-distance Bus Terminal)		30		30
Category C : Traffic Management Plan				
CL-1. Reduction of Roadside Parking				
(1) Construction of 3 nos. of Parking in City Center		9,000		9,000
CL-2 Streamlining of Pedestrian Flow				
(1) Construction of 2 Pedestrian Bridges		175		175
(2) Improvement of Pedestrian ways		4,725		4,725
Subtotal(2)		55,170	0	55,170
Total		168,560	1,140	169,700

(Exchange Rate : 1.00US\$=Tshs.490-Y110)

11.3 High Priority Projects for Feasibility Study

The road development projects proposed for the Short-term Plan have been evaluated to select high priority projects, taking into consideration the following factors: (Refer to Table 11.4)

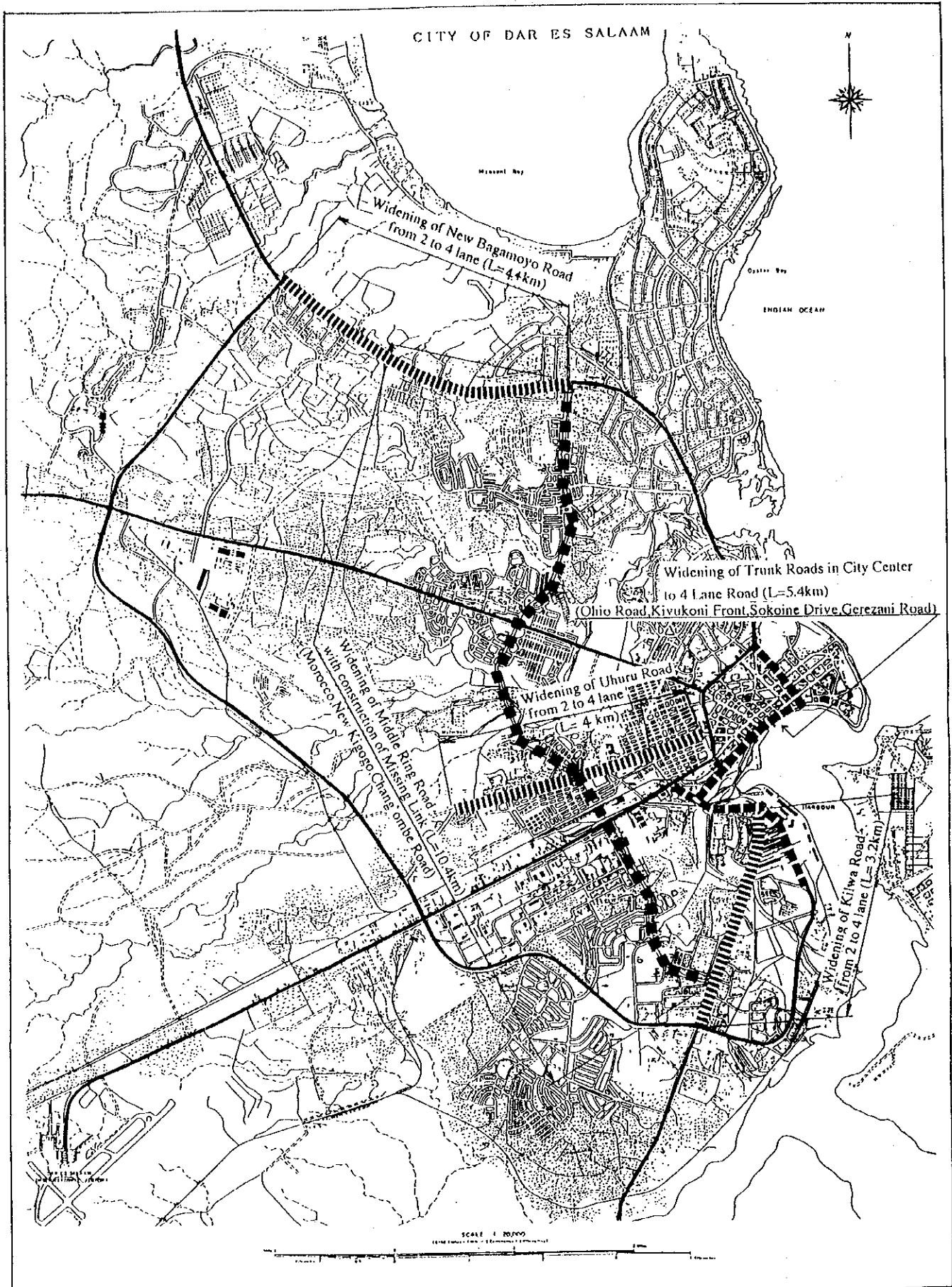
- Enhancement and improvement of urban traffic efficiency
- Promotion and stimulation of potential suburban development
- Prevention of haphazard urban sprawl
- Required fund for construction
- Improvement of accessibility to public transport services
- Ease of construction in terms of land acquisition and local funds
- Necessity of high construction technology
- Urgency of the project from the viewpoint of safety
- Contribution to non-motorized transport
- Improvement of roadside environment

The following are the high priority projects selected for the Feasibility Study: (See Fig. 11.3)

- (1) Package AS-1; **Widening of Arterial Roads in Central Area including the following works:**
 - (AS-1-1) Widening of Ohio, Sokoine, Gerezani and Bandari Road from 2 to 4 lane road including reconstruction of Gerezani Bridge
 - (AS-1-2) Reconstruction of city bus terminal located near the park along Sokoine Drive
 - (AS-1-3) Construction of seaside promenade with car parking lots
- (2) Package AS-2; **Widening of Middle Ring Road with Construction of Missing Link including:**
 - (AS-2-1) Widening of the Middle Ring Road from 2 to 4 lane road including the provision of sidewalks on both sides
 - (AS-2-2) Construction of Missing Link between New Kigogo and Chang'ombe Roads
 - (AS-2-3) Construction of bus stations for changing at every important intersection of radial trunk roads
- (3) Package AS-3; **Widening of Radial Trunk Roads from 2 Lanes to 4 Lanes including:**
 - (AS-3-1) Widening of New Bagamoyo Road from Morocco Road Junction up to Mpakani Road Junction
 - (AS-2-2) Widening of Uhuru Road from Gerezani up to the 4 lane section
 - (AS-2-3) Widening of Kilwa Road from Bandari Road up to Mandela Road

Table 11.4 Selection of High Priority Projects to be Conducted for Feasibility Study

Evaluation Items	Road Development Projects Proposed in the Short-term Plan							
	AS-1 Widening of Arterial Roads in City Center	AS-2 Widening of Middle Ring Road and Construction of Missing Link	AS-3 Widening of Trunk Road from 2 to 4 lane	AS-4 Strengthening of Road Network in Kigamboni Areas	AS-5 Construction of Outer Ring Road	AS-6 Strengthening of Road Network Along Pugu Road	AS-7 Const. And Improv. Of Important Roads in Rural Areas	AS-8 Reconstruction of Bridges
1. Enhancement and Improvement of Urban Traffic Efficiency	A	A	A	C	B	C	C	C
2. Promotion and Simulation of Potential Suburban Development	B	A	A	A	A	A	A	C
3. Prevention of Haphazard Urban Sprawl	B	A	B	A	A	A	A	C
4. Required Fund for Construction	B	C	C	B	C	B	A	B
5. Improvement of Accessibility to the Public Transport Service	A	A	A	B	A	A	C	C
6. Ease of Construction in Terms of Land Acquisition and Local Fund	C	C	A	B	B	B	B	A
7. Necessity of High Construction Technology	A	A	A	B	B	B	C	A
8. Urgency of the Project from the View Point of Safety	B	B	C	C	C	C	C	A
9. Contribution to Non-Mortarized Transport	A	A	A	B	B	B	C	A
10. Improvement of Road-side Environment	B	A	B	B	A	B	A	C
Total Score	23	25	24	20	22	21	19	19
Priority	3	1	2	6	4	5	7	7
RECOMMENDED HIGH PRIORITY PROJECTS TO BE CONDUCTED FOR FEASIBILITY STUDY	0	0	0					



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Fig. 11.3 High Priority Projects
Selected for the Feasibility Study

- ■ ■ ■ Package AS-1 Widening of Arterial Roads in City Center (L=5.4km)
- — — — Package AS-2 Widening of Middle Ring Road with Construction of Missing Link (L=10.4km)
- ▨▨▨▨ Package AS-3 Widening of Radial Trunk Roads from 2 to 4 lane (L=11.6km)

SUMMARY OF THE STUDY

PART B: FEASIBILITY STUDY

Chapter 12 INTRODUCTION

12.1 General

As stated in the Master Plan Study (Part A of this Report), high priority projects were selected among the road development plans proposed in the short-term plan with the target year 2000.

A Feasibility Study for the development of the projects was conducted during June - November 1994 in accordance with the Scope of Works mutually agreed by the Tanzanian Government and the Japanese Government on May 30, 1994. All findings and issues of it have been compiled in Chapter 12 through Chapter 20 herein and are presented as **Part B: Feasibility Study for High Priority Projects**.

12.2 Subject Roads for the Feasibility Study

As discussed in Section 11.3, Chapter 11, Part A: Master Plan Study, the Feasibility Study was to be conducted for the following three packages of the high priority road projects.

(i) **Package 1:**

Widening of Arterial Roads in Central Area, including Ohio, Kivukoni, Sokoine, Gerezani and Bandari Roads from 2 to 4 lanes which includes reconstruction of Gerezani Bridge with 4 lanes (total length of about 5.4 km), reconstruction of the city bus terminal located near the park along Sokoine Drive and construction of a seaside promenade with parking lots for ferry users.

(ii) **Package 2:**

Widening to 4-lanes of the Middle Ring Road which consists of Morocco Road, New Kigogo Road and Chan'gombe Road with construction of the Missing Link (total length of about 9.9 km).

(iii) **Package 3:**

Widening to 4 lanes of Radial Trunk Roads including New Bagamoyo Road from the Morocco Road Junction up to the Mpakani Road Junction (total length of about 4.4 km), Uhuru Road from the UWT Road to the Mandela Road (total length of about 4.8 km) and Kilwa Road from Bandari Road up to the Mandela Road Junction (total length of about 3.2 km).

Chapter 13 BASIC DESIGN STANDARDS AND RIGHT-OF-WAY

13.1 General

In this chapter, the basic engineering aspects including design standards and standard cross-sections to be applied for the proposed roads as well as the basic plan for the right-of-way (ROW) have been studied.

13.2 Design Standards

(1) Functional Classification of the Proposed Roads

All proposed roads have been classified into the category of "Trunk Roads" referring to the "Draft Road Manual" as well as the existing road conditions and land-use pattern along the road, considering the following:

- (i) They will form a part of the primary road network system in Dar es Salaam city.
- (ii) They will be widened to four lanes based on approved design standards.
- (iii) They will carry a large traffic volume in the future.

(2) Design Speed

The design speed to be applied for each proposed road was established taking into account the road classification, traffic volume, terrain condition and land-use situation along the roads.

The project design life to be used for the economic evaluation is assumed to be 20 years after completion of the Project.

(3) Basic Design Standards

The design standards are determined considering the design speed, land-use situation along the proposed road, the characteristics of traffic movement and anticipated future traffic demands. The proposed major design elements such as number of lanes, carriageway width, type and dimension of shoulder/median strip, sidewalks, bicycle lane, bus lane, etc. were studied and summarized as shown in Table 13.1.

Table 13.1 Proposed Basic Design Standards

Proposed Roads	Design Speed (km/hr)	Number of Lane	Type of Road	Carriageway Width (m)	Median Strip (m)	Type of Surface	Pedestrian Sidewalk (m)	Cycle Lane (m)	Applicability of Bus Lane	
									Priority use	Exclusive use
1 Package 1: Arterial Roads in the City Center										
- Ohio Street	40	Dual 2-lane	A	Dual 2x3.5	1.0	Paved	2.0 - 3.0	Combined	Applicable	
- Kivukoni Front	40	Dual 2-lane	A	Dual 2x3.5	1.0	Paved	2.0 - 3.0	Combined	Applicable	
- Sokoine Drive	40	Dual 2-lane	A	Dual 2x3.5	1.0	Paved	2.0 - 3.0	Combined	Applicable	
- Seaside Promenade						Paved	5.0 - 8.0	Combined		
- Gerezani Street	40	Dual 2-lane	A	Dual 2x3.75	1.0	Paved	2.0 - 3.0	Combined	Applicable	
- Bandari Road	40	Dual 2-lane	A	Dual 2x3.75	1.0	Paved	2.0 - 3.0	Combined	Applicable	
2 Package 2: Middle Ring Road										
- Morocco Road	60	Dual 2-lane	A	Dual 2x3.75	7.0 - 10.0	Paved	2.0 - 5.0	2.0 - 3.0	Applicable	Applicable
- New Kigogo Road	60	Dual 2-lane	A	Dual 2x3.75	7.0 - 10.0	Paved	2.0 - 5.0	2.0 - 3.0	Applicable	Applicable
- Chang'ombe Road	60	Dual 2-lane	A	Dual 2x3.75	1.0	Paved	2.0 - 3.0	2.0 - 3.0	Applicable	
- Missing Link	60	Dual 2-lane	A	Dual 2x3.75	1.0	Paved	2.0 - 3.0	Combined	Applicable	
3 Package 3: Radial Trunk Road										
- New Bagamoyo Road	80	Dual 2-lane	A & B	Dual 2x3.75	3.0 - 7.0	Paved	2.0 - 5.0	2.0 - 3.0	Applicable	Applicable
- Uhuru Road(UWT - Mzimbazi Rd) *	40	Dual 2-lane	A	2 x 2x3.50	-	Paved	2.5	Combined	Applicable	
- Uhuru Road(Msimbazi Rd - Mandela Rd)	40	Dual 2-lane	A	Dual 2x3.75	1.0	Paved	2.0 - 5.0	Combined	Applicable	
- Kiliwa Road	60	Dual 2-lane	B	Dual 2x3.75	7.0 - 10.0	Paved	2.0 - 5.0	2.0 - 3.0	Applicable	Applicable

Notes:

* Oneway system is introduced.

Type A: Road without shoulder (city road type)

Type B: Road with shoulder (rural road type)

Combined: Use for both pedestrians and cyclists

13.3 Standard Cross-sections

The Draft Road Manual prepared by the Ministry of Works, Communications and Transport (MWCT) is applicable only for rural trunk roads (not for urban roads). Therefore, standard cross-sections to be applied for the proposed roads have been established by the Study Team based on Japanese Road Standards as well as British Road Standards.

Fig. 13.1 shows the typical cross sections by type of road function.

13.4 Right-of-way Plan

(1) Basic Concept for Right-of-Way Plan

For the purpose of the Study, the Team established the basic concepts for planning of the right-of-way design as follows:

- (i) The ROW for the proposed roads should be in accordance with the MWCT's standard wherever applicable.
- (ii) The improvement measures for the proposed roads are mostly widening of an existing road to four lanes and also the land-use situation is fairly well developed. Therefore, the road design should be done within the present ROW strip as much as possible to minimize the additional land/house acquisition and compensation.

(2) Proposed Right-of-way Standard

The standard ROW specified in MWCT Road Design Manual shall be applied only to the rural roads or roads which run in the non-urbanized areas. As for the urban streets, the boundary line along the road or buildings located on both sides of the street shall be identified as the limits of the ROW strip unless the ROW limits are already clearly specified in the ROW map.

The JICA Study Team has recommended to apply a minimum ROW width for particular sections where the land-use situation seems to be extremely tight and difficult. See Table 13.2.

The ROW area for those intersections where a grade-separation is planned in the long-term, such as the intersections between Morogoro/Morocco Roads, Uhuru/New Kigogo Roads and Pugu/Chang'ombe Roads, should be reserved in sufficient widths for future development.

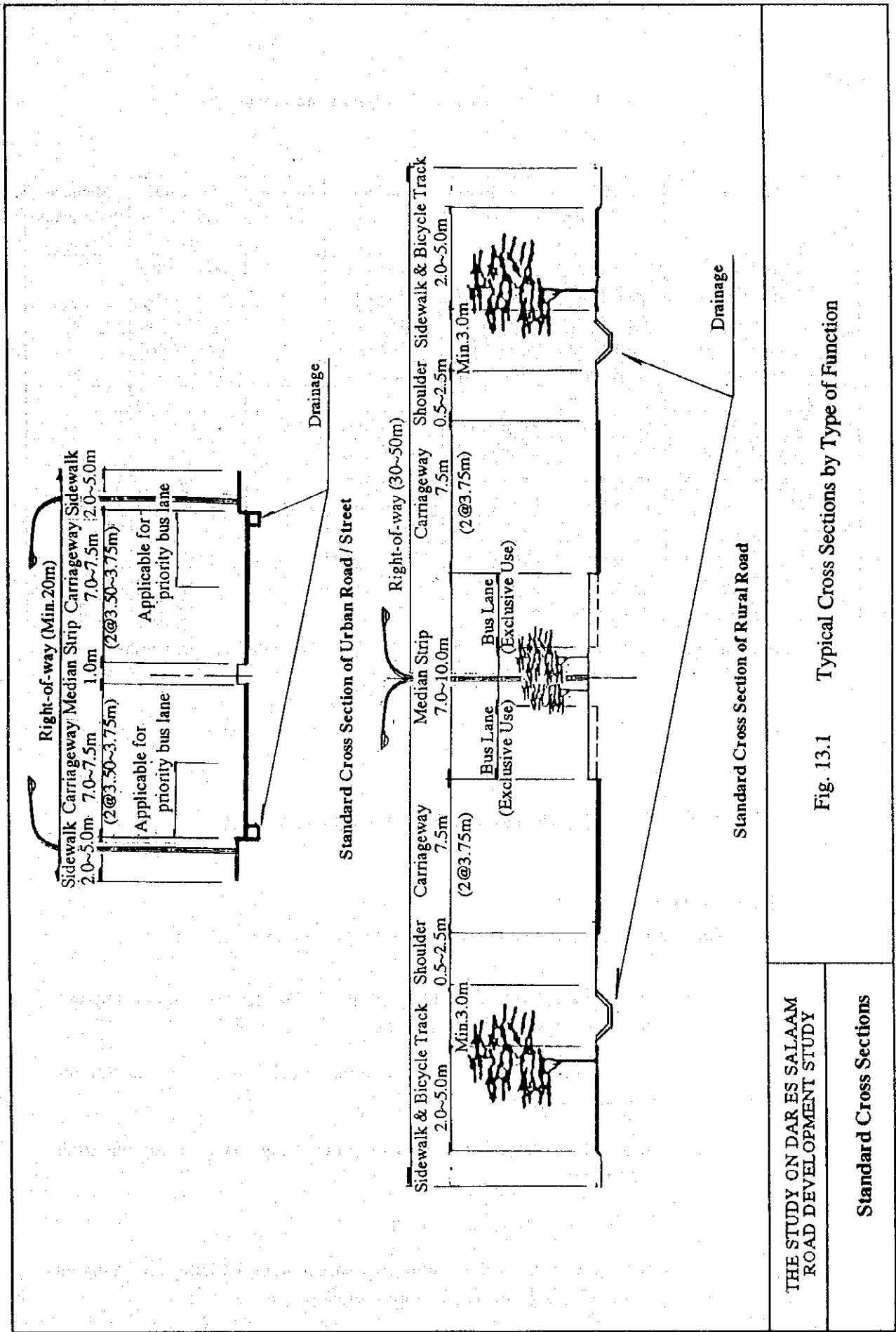


Fig. 13.1 Typical Cross Sections by Type of Function

THE STUDY ON DAR ES SALAAM ROAD DEVELOPMENT STUDY

Standard Cross Sections

Table 13.2 Proposed Right-of-Way Standards

Proposed Road	MWCT's Classification	Present Pattern of ROW	Land-use Situation	Proposed Lane Nos.	Standard ROW Width (m)	Minimum ROW Width* (m)
Package 1						
- Ohio Street	Trunk Road	Urban Street	CBD area	4	Not specified	20
- Kivukoni Front	Trunk Road	Urban Street	CBD area	4	Not specified	20
- Sokoine Drive	Trunk Road	Urban Street	CBD area	4	Not specified	20
- Gerezani Street	Trunk Road	Urban Street	CBD area	4	Not specified	20
- Bandari Road	Trunk Road	Urban Street	CBD area	4	Not specified	20
Package 2						
- Morocco Road	Trunk Road	Rural Road	Urban Area	4	45	30
- New Kigogo Road	Trunk Road	Rural Road	Urban Area	4	45	30
- Chang'ombe Road	Trunk Road	Rural Road	Urban Area	4	30	25
- Missing Link	Trunk Road	Rural Road	Urban Area	4	30	25
Package 3						
- New Bagamoyo Rd	Trunk Road	Rural Road	Sub-urban area	4	45	30
- Uhuru Road	Trunk Road	Rural Road	Sub-urban area	4	45	25
- Kilwa Road	Trunk Road	Rural Road	Urban Area	4	30	25

CBD: Central Business District

Note *: Recommended by the Study Team

CHAPTER 14 ENGINEERING SURVEY AND ANALYSIS

14.1 General

The engineering surveys were conducted to the following items:

- 1) Geological investigations at proposed bridge sites including box culverts and shore protection site.
- 2) Subsoil investigation on the subgrade of the proposed road for the pavement design.
- 3) Materials investigation of borrow pit areas, quarry sites and materials for structure.
- 4) Hydrological study and analysis.
- 5) Topographical survey including supplemental plane surveying at proposed bridge sites and shore protection site.

14.2 Geological Investigations for the Proposed Sites for Structures

The test boring was performed using drilling machine of hydraulic driven rotary type at one or two location(s) for every proposed site. The boreholes were drilled to a depth of 20.0m. The test borings were conducted for the proposed sites for the structures.

The standard penetration test was performed at one meter depth interval in each borehole. Disturbed samples were also taken at one meter interval in each borehole. The samples were tested according to AASHTO or ASTM methods at the Central Materials Laboratory.

Test result shows that most of the layers in the boreholes were composed of medium dense sand except for location No. 6 where very loose soil was found. These test results were reflected to the proposed bridges and the structural design.

14.3 Subsoil Investigation

The subsoil investigation was conducted to clarify suitability as subgrade material of the existing subsoil on the high priority project roads. 28-test pits were selected at 1.0 km interval along the project roads for the investigation.

The test pits were dug with 1.0m width, 1.0m length and 1.5m depth along the project roads. Two disturbed samples were taken at each selected test pit. The samples were tested according to AASHTO or ASTM methods at the Central Materials Laboratory. At the same time, the investigation of the pavement structure was conducted at each selected test pit to confirm the thickness of the existing base and surface course.

Based on the CBR Values obtained through the above investigations, the design CBR values of project roads for the pavement thickness design were estimated according to the method in "Manual for Asphalt Pavement, 1989" published by the Japan Road Association as follows:

-6% : Ohio – Gerezani, Bandari, Morocco, Missing Link,
Chang'ombe and New Bagamoyo Roads

-4% : New Kigogo, Uhuru and Kilwa Roads

14.4 Materials Investigations

The materials investigations were conducted for the following purposes:

- To identify borrow pit areas from which suitable subgrade materials can be taken.
- To identify quarry sites from which suitable coarse and fine aggregates can be taken.
- To identify availability of materials for concrete structures.

(1) Potential Borrow Pit Areas

The borrow pit areas around the project roads were investigated on the basis of interviews with the Ministry of Works, Communications and Transport and other organizations concerned.

The potentiality of these borrow pit areas were determined from the viewpoint of the estimated deposit, their quality, accessibility and workability at site.

"Pugu" and "Chamazi" are recommendable as potential borrow pit areas, since non-plastic fine sand suitable for subgrade can be taken with an estimated deposit being sufficient.

(2) Potential Quarry Sites for Aggregate

The investigations were conducted to the following quarry sites for aggregates of pavement and concrete structures:

- Kunduchi Area Quarries, Msolwa Quarry, Mikese Quarries, Melela, Kitumbi, Lugoba (Mindutriani), Kigamboni (Mjimwema), Mpiji.

The potentiality of these quarry sites was determined in view of hauling distance, estimated deposit, quality, accessibility and workability at site. The following are the summary of investigations and recommendations:

(i) Coarse Aggregate for Surface Course and Concrete

Although the hauling distance is comparatively far from Dar es Salaam, Lugoba (Mindutriani) is recommendable as a quarry site, since sufficient deposit and suitable coarse aggregate for surface course and concrete could be taken.

(ii) Coarse Aggregate for Base Course

The aggregates from Kigamboni (Mjimwena) quarry is recommended for the base course materials because the Kunduchi quarry has insufficient deposit which is obvious to exhaust in coming several years.

(iii) Fine Aggregate

The suitable fine aggregates for both asphalt mixtures and structural concrete can be taken in Mpiji quarry.

14.5 Hydrological Study and Analysis

(1) Probable Daily Rainfall

The probable daily rainfall in the project area was analyzed by means of the following three statistical methods using maximum daily rainfall at Dar es Salaam Airport.

- 1) Hazen Method
- 2) Gumbel Method
- 3) Pearson Type III Method

Out of the above three statistical methods, the Gumbel method has indicated the highest value in each return period. Thus, the value in Gumbel Method was applied as the probable daily rainfall for further analysis.

(2) Flood Discharge

There are four crossing points over the major rivers involved in the high priority project roads; namely, Msimbazi, Ubungo/Ruhanga, Sinza and Kijitonyama Rivers.

The flood discharge at these crossing points were estimated for the purpose of determining the dimension of drainage structures. The Rational Formula was applied for estimation of flood discharge.

14.6 Topographical Survey

Supplemental plane surveys with a scale of 1/500 were conducted at the proposed sites for bridges, box culverts, retaining wall and slope protection work. The other preliminary design including road alignment and drainage was based on the existing topographic maps in scale of 1/2,500 edited from aerial photos taken in 1992.

CHAPTER 15 PRELIMINARY ENGINEERING DESIGN

15.1 General

The preliminary engineering design was conducted in the following items:

Alternative Route Study, Highway Design including Intersections, Bridge and Structural Design, Drainage Design, Pavement Design, Road Facilities Design, Public Utilities Design and Preliminary Right-of-way Plan.

15.2 Alternative Route Study

(1) Missing Link of the Middle Ring Road

Three alternative routes were considered for the Missing Link between New Kigogo and Chang'ombe Road as shown in Fig. 15.1.

The alignment of Alternative 2, utilizing the open space of Karume Memorial Stadium and running along the fence on the boundary between Memorial Stadium and the cemetery, is recommended considering the ease of implementation as well as the comparatively low cost required for the compensation of land acquisition and house removal.

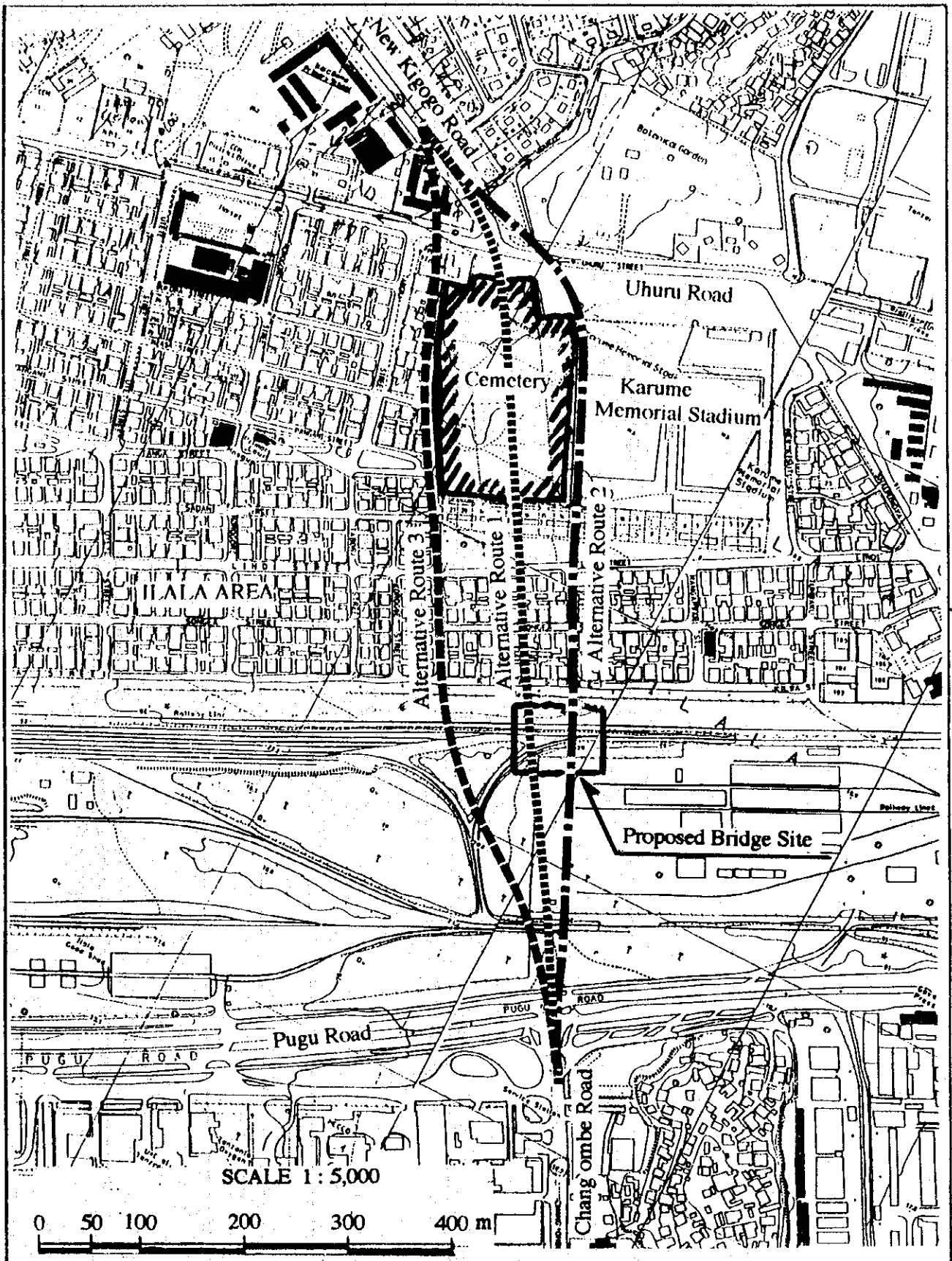
The proposed route, however, has to cross over three railway track lines in this section. Two alternative profiles were considered; Profile 2-1 is to fly over by bridge and Profile 2-2 is to cross over at-grade with the existing railways. Profile 2-2 is recommended from the engineering and economical viewpoint, though a political decision might be needed for the realignment of TRC railway line.

(2) Kariakoo Section of Uhuru Road

Two alternative routes were considered for the Kariakoo Section of Uhuru Road as follows:

- (i) Option 1: Widening of the Existing Uhuru Road to 4 Lanes.
- (ii) Option 2: Introduction of a One-way System on Uhuru Road with widening to a 2-lanes Kipata Street as shown in Fig. 15.3.

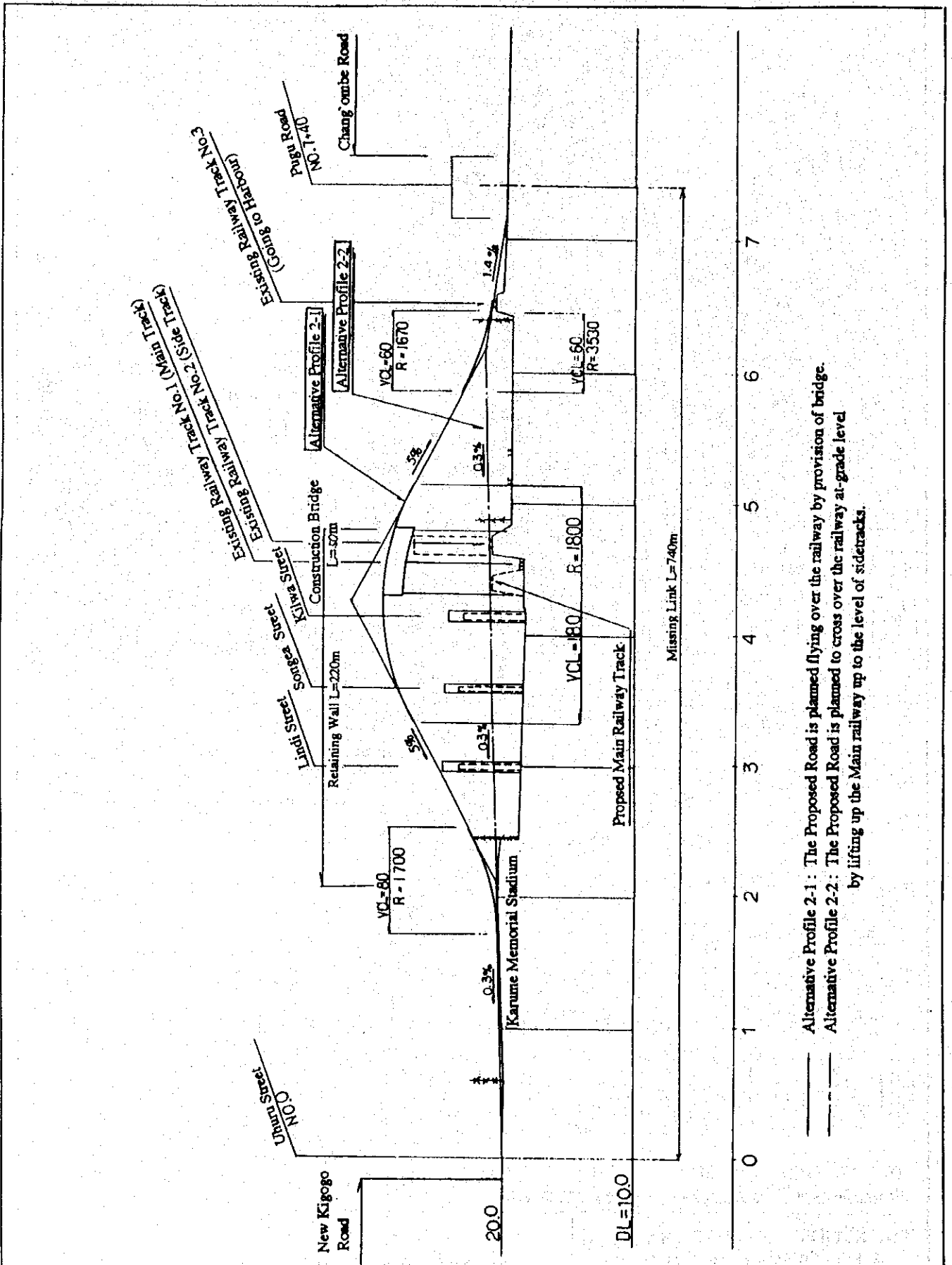
Option 2 is recommended considering ease of the implementation from the viewpoint of right-of-way situation as well as the lower cost for land/house acquisition and compensation.



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Fig.15.1
 Alternative Routes on Missing Link of the Middle Ring Road

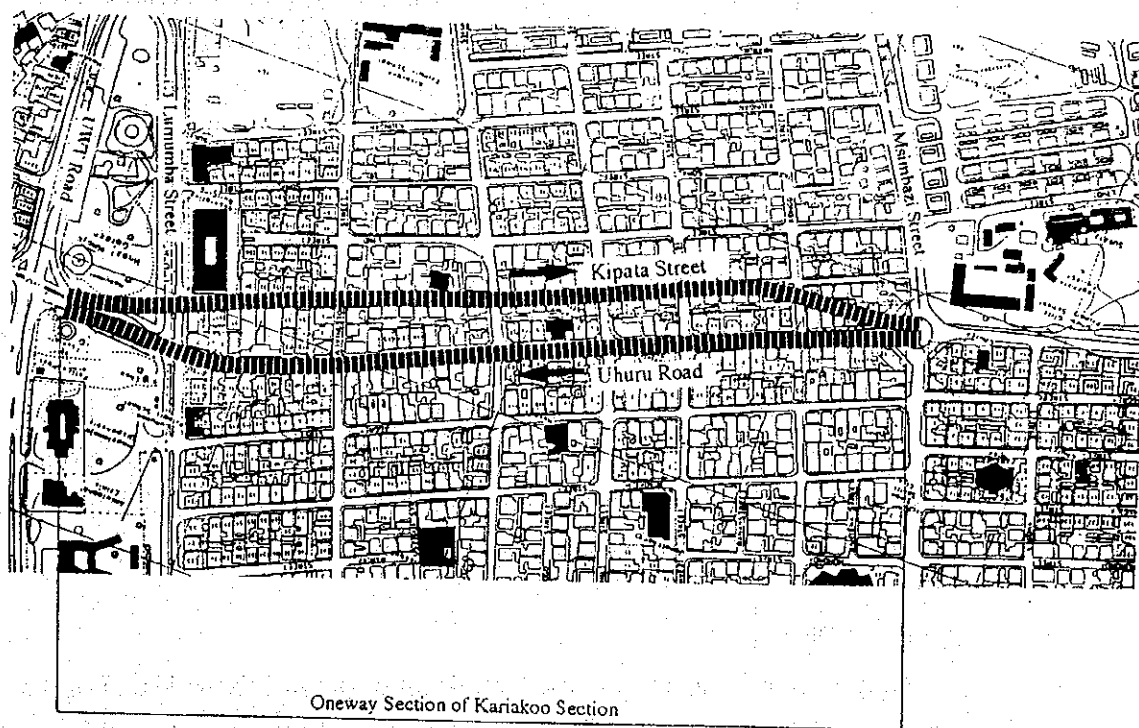
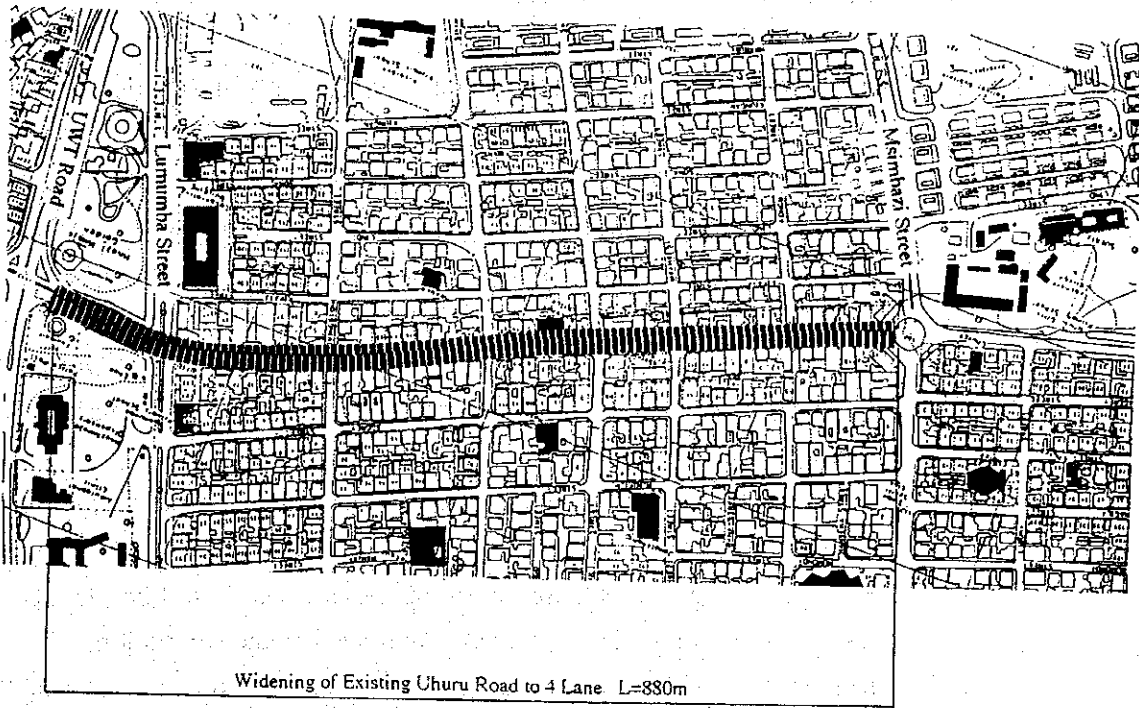
- Alternative Route 1
- Alternative Route 2 (Recommendation)
- Alternative Route 3



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Fig. 15.2 Alternative Profile for the Missing Link

Fig. 15.3 Alternatives Routes on Uhuru Roads



15.3 Highway Design

(1) Basic Concept of Highway Design

The basic concepts for the preliminary design were established before commencing the work as shown below.

- (i) The geometric design should meet the requirements of the arterial road with high standard.
- (ii) The characteristics of the traffic components as well as the local movement; that is, large-size heavy vehicles, non-motorized transport, large number of pedestrians, etc. should be taken into account for the design.
- (iii) Widening of the existing road should be designed inside the present ROW strip as much as possible to minimize the removal of houses and buildings.
- (iv) The road drainage should be properly connected to the existing storm drainage system.
- (v) Relocation and/or protection of the public utilities should be planned taking into account the ease of repair and maintenance operation.
- (vi) Bus services are the main means of public transport in Dar es Salaam, so that the provision of bus facilities should be properly designed in coordinaton with the agencies concerned.
- (vii) ROW plan should cover the space required for grade separation at the ultimate stage to accommodate the anticipated future traffic demand.

(2) Geometric Design Standards

Geometric design standards to be applied for each road are directly related to the design speed. Table 15.1 shows the proposed geometric design criteria to be applied for each road.

(3) Typical Cross-sections on Proposed Roads

The width and layout of a road will depend largely upon land-use conditions as well as the type, volume and speed of the traffic it will carry. The various components of the road for accommodation and safety of vehicular and pedestrian traffic have been considered in each proposed road.

(4) Alignment Design

The improvement measures proposed in this Study are mainly widening of the existing roads from two to four lanes so that no remarkable alignment changes

are required. The control points considered in the alignment design are the roads to be intersected, land-use situations, historical monuments to be conserved, public facilities and utilities.

In order to minimize construction, the alignments of the new roads are planned to utilize the existing roads as much as possible provided that the pavement condition of the existing roads are reasonably maintained and in good condition.

The alignment of each proposed road are presented in Fig. 15.4, Fig. 15.5 and Fig. 15.6.

15.4 Intersection Design

(1) Major Intersections

The intersections where the volume of crossing and turning traffic is large are identified as major intersections as shown in Fig. 15.7. The major intersections are controlled by traffic signals with channelisation in view of safety and congestion.

At these major intersections, the following design elements were considered where the road widths are not restricted:

Full visibility to the right and left turning lanes, transition or compound curves on the corners, channelising islands, guard rails, refuge islands, pedestrian crossings with signal control, lighting, marking and sign posts.

(2) Grade Separated Intersections

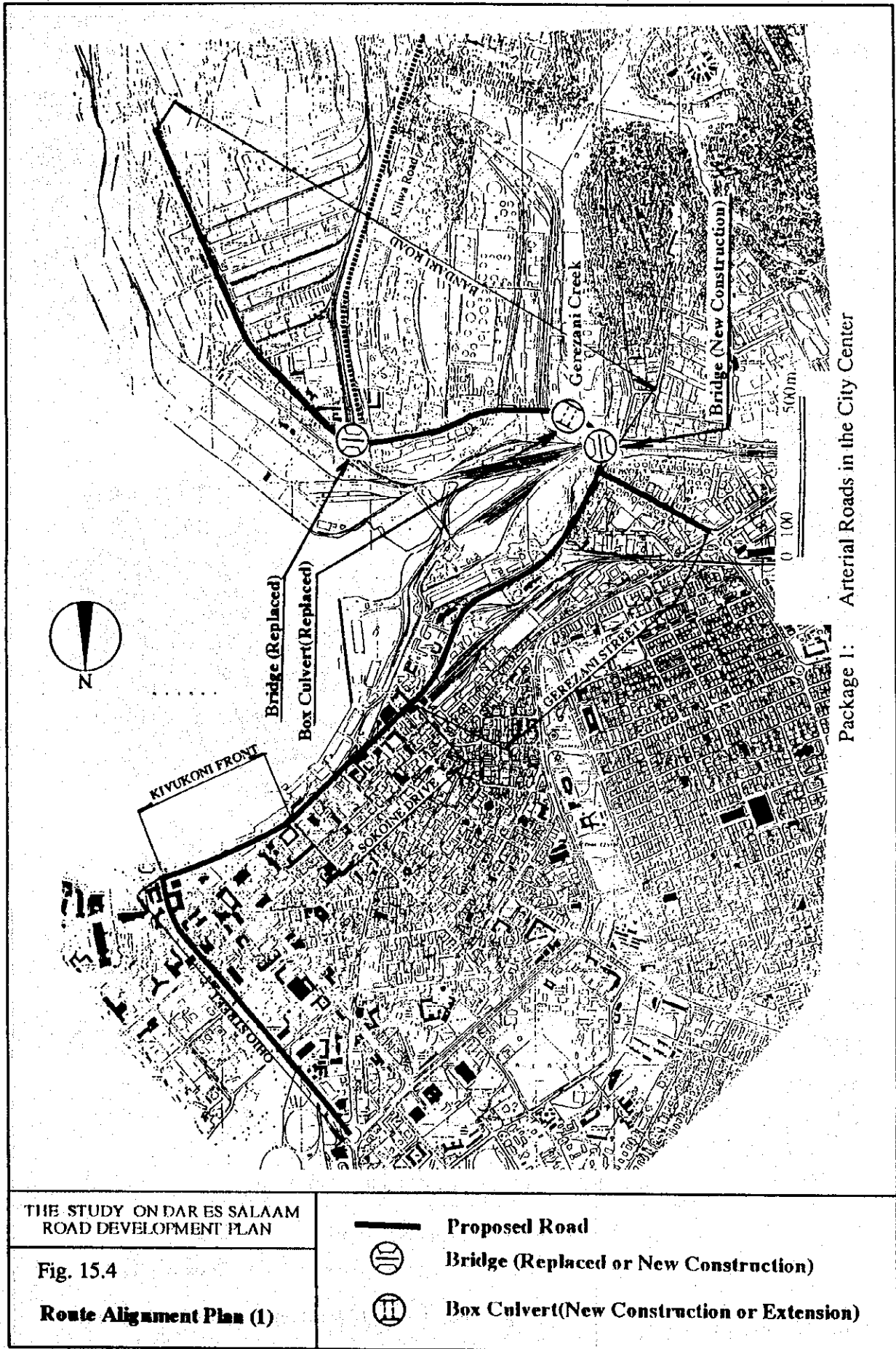
Out of the above major intersections, the following three are planned to be grade separation in the long-term as discussed in the Master Plan Study:

- Morocco/Morogoro Road Intersection
- New Kigogo/Uhuru Road Intersection
- Pugu/Chang'ombe Road Intersection

The locations of these intersections are shown in Fig. 15.8. Though the implementation of these grade separations have been recommended for the Long-term Plan, land acquisition should be made in advance to secure necessary construction sites for the grade separations. This will be necessary to control the rising compensation costs as well as the development of nearby intersections.

Table 15.1 Proposed Geometric Design Standards

Proposed Roads	Design Speed (km/hr)	Min. Radius Desirable (m)	Min. Radius Absolute (m)	Min. Radius for no Transition (m)	Maximum Gradient (%)	Normal Camber (%)	Normal Shoulder slope (%)	Stopping Sight Distance (m)	Passing Sight Distance (m)
1 Package 1: Arterial Roads in the City Center									
- Ohio Street	40	75	50	220	6.0	2.0	3.5	40	250
- Kivukoni Front	40	75	50	220	6.0	2.0	3.5	40	250
- Sokoine Drive	40	75	50	220	6.0	2.0	3.5	40	250
- Gerezani Street	40	75	50	220	6.0	2.0	3.5	40	250
- Bandari Road	40	75	50	220	6.0	2.0	3.5	40	250
2 Package 2: Middle Ring Road									
- Morocco Road	60	150	125	500	5.0	2.0	3.5	75	400
- New Kigogo Road	60	150	125	500	5.0	2.0	3.5	75	400
- Chang'ombe Road	60	150	125	500	5.0	2.0	3.5	75	400
- Missing Link	60	150	125	500	5.0	2.0	3.5	75	400
3 Package 3: Radial Trunk Roads									
- New Bagamoyo Road	80	300	230	900	4.0	2.0	3.5	115	550
- Uhuru Road	40	75	50	220	6.0	2.0	3.5	40	250
- Kilwa Road	60	150	125	500	5.0	2.0	3.5	75	400



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Fig. 15.4

Route Alignment Plan (1)



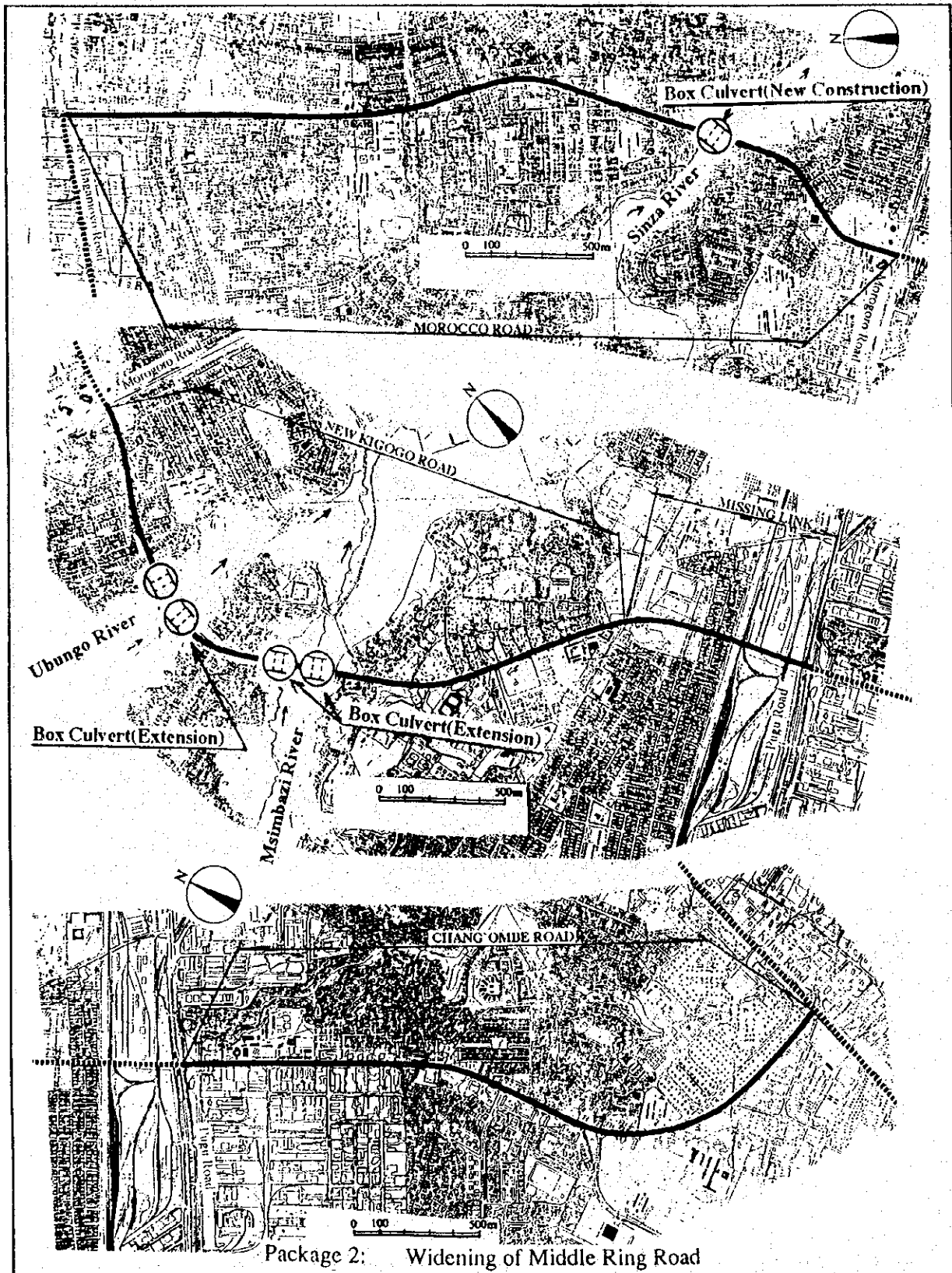
Proposed Road



Bridge (Replaced or New Construction)



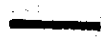


Box Culvert (New Construction or Extension)

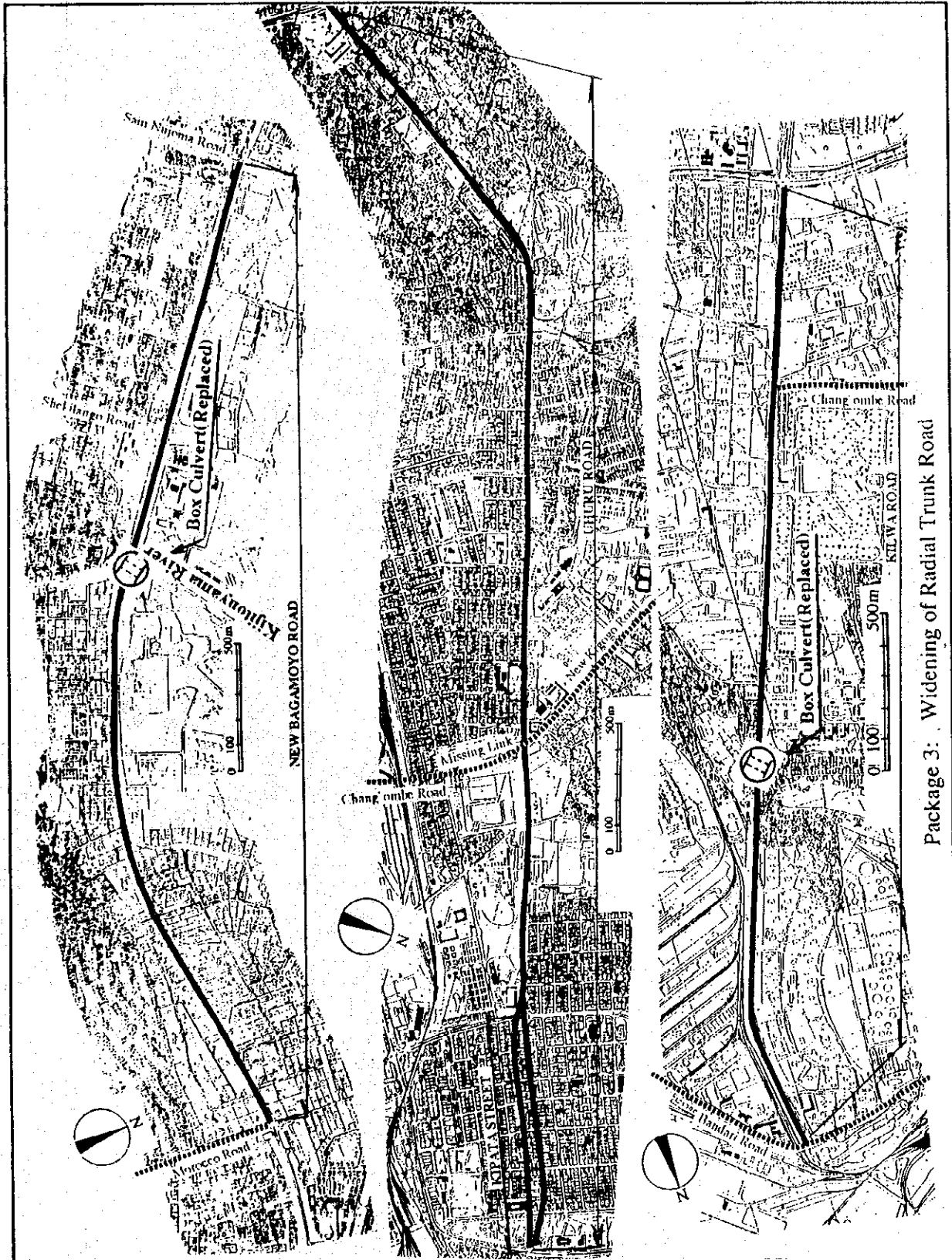


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ROAD DEVELOPMENT PLAN



Fig. 15.5

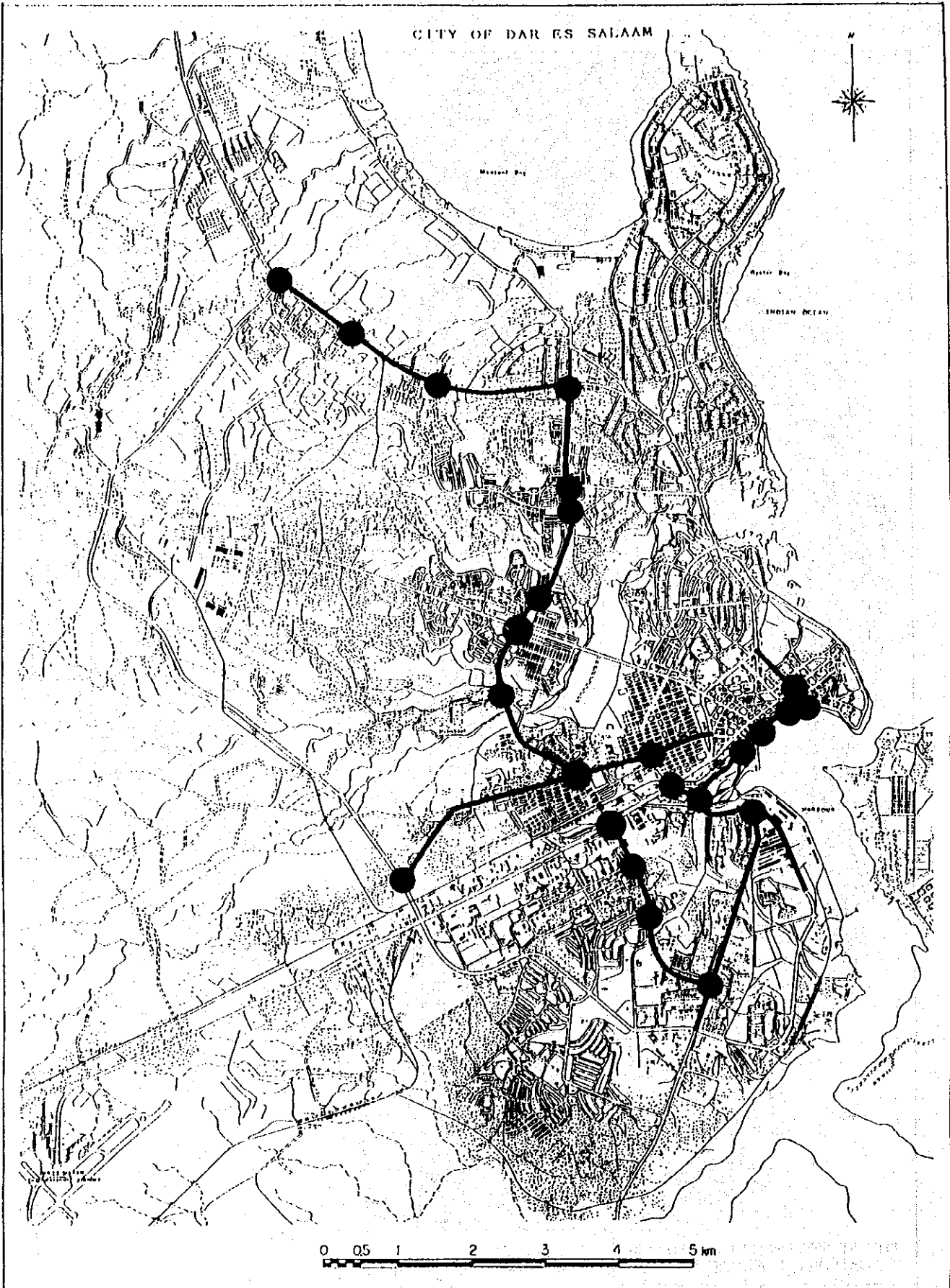
Route Alignment Plan (2)

-  Proposed Road
-  Bridge (Replaced or New Construction)
-  Box Culvert (New Construction or Extension)



Package 3: Widening of Radial Trunk Road

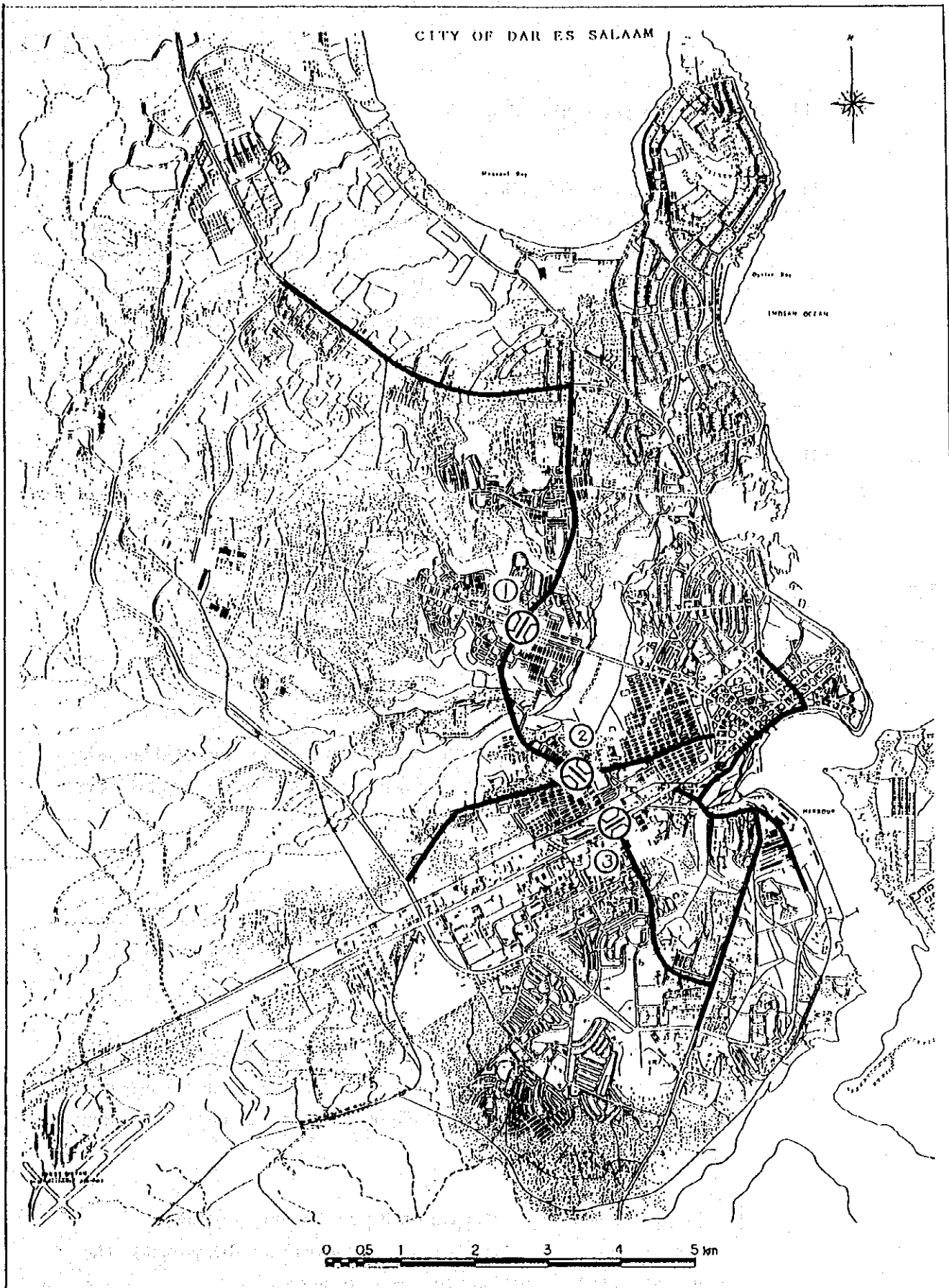
<p>THE STUDY ON DAR ES SALAAM ROAD DEVELOPMENT PLAN</p>	<p>— Proposed Road</p>
<p>Fig. 15.6</p>	<p> Bridge (Replaced or New Construction)</p>
<p>Route Alignment Plan (3)</p>	<p> Box Culvert (New Construction or Extension)</p>



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Major Intersections(Signal Controlled)		●
New Bagamoyo Road	: 3 places	
Middle Ring Road	: 8 places	
Uhuru Road	: 2 places	
Arterial Roads in City Center	: 8 places	

Fig. 15.7 Major Intersections



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Fig. 15.8
Grade Separated Intersections

Grade Separated Intersections Proposed for high priority roads

- ① — Morocco / Morogoro Road Junction in Long Term Plan
- ② — New Kigogo / Uhuru Road Junction
- ③ — Chang'ombe / Pugu Road Junction

15.5 Bridge and Structural Design

(1) Design Standards to be Applied for Bridge Design

Highway Bridge Specifications published by the Japan Road Association (JRA: B-Loading T-25) have been applied for the bridge design instead of HA Loading (BS 5400:HA+HB 25) or HS20 (AASHTO: HS 20 - 40 Loading) because the comparison of JRA, AASHTO (HS 20-44) and BS 5400(HB25) by live loads indicated that B-Loading of JRA is compatible with AASHTO and BS standards.

(2) Alternative Bridge Planning

Alternative study were conducted for the following proposed bridges:

Proposed Site No.1: Sinza River at Morocco Road

Proposed Site No.4: Gerezani Bridge on Railway Crossing

Proposed Site No.5: Bandari Bridge on Railway Crossing

Proposed Site No.6: Ilala Bridge on Railway Crossing at the Missing Link of the Middle Ring Road

Out of the above bridge sites, No.6 Ilala Bridge was finally canceled because the Middle Ring Road has been determined to cross the railway tracks at the same level, not to cross over by a bridge.

(i) Proposed Site No.1: Sinza Bridge at Morocco Road

Two alternatives were considered for the proposed site on the Sinza River, namely box culvert and reinforced concrete hollow slab bridge as shown in Fig. 15.9.

The box culvert has been recommended for the proposed site on the Sinza River from the economical point of view, since the construction cost of the bridge will become almost two times as large as the box culvert.

(ii) Proposed Site No.4: Gerezani Bridge on Railway Crossing

The proposed bridges will pass over the existing railway tracks. The following types of superstructure were considered:

a) Reinforced Concrete Simple Hollow Slab (RC-SH)

b) Non-composite Simple Steel Plate Girder (St-Gr)

Layout of the bridge is presented in Fig. 15.10. The reinforced concrete simple hollow slab type has been selected for the Gerezani Bridge in view of lower construction cost as well as ease of maintenance.

(iii) **Proposed Site No.5: Bandari Bridge on Railway Crossing**
Two alternatives have been considered in regard to the topographic conditions and geographical conditions as shown in Fig. 15.11.

- a) **Alternative 1:**
Non-composite Simple Steel Plate Girder Bridge (St - Gr) with Concrete Block Abutment and Pile Foundations
Bridge Length : 27.0 m
Abutment : Gravity type wall
Foundation : Concrete pile D=450 mm
- b) **Alternative 2:**
Reinforced Concrete Simple Hollow Slab (RC-HS) with Retaining Wall Abutment without Pile Foundations
Bridge Length : 10.8 m
Abutment : T type retaining wall
Foundation : No pilings

Alternative 2 (Concrete Simple Hollow Slab Bridge) is recommended for the Bandari Bridge because of lower construction cost and ease of maintenance.

(3) **Box Culvert Design**

The box culverts are proposed at the following three places:

(i) **Sinza River at Morocco Road**

The existing pipe culverts shall be replaced by box culverts as stated in the paragraph "Alternative Bridge Planning".

The design discharge of box culverts is calculated at 95.8 m³/sec, while the flood discharge of the Sinza River 65.1 m³/sec. Allowance (or safety ratio) of the capacity is 1.47, which will enough satisfy with the estimated flood discharge of the Sinza River.

(ii) **Ubungo River at New Kigogo Road**

Two box culverts are set up on the Ubungo River at New Kigogo Road. The investigation revealed that these culverts are in sound condition and have a sufficient capacity against the flood discharge so that they can be used for the project road as they are without any major improvement. Extension of box culverts will be made having the same dimensions of the existing culverts as shown in Fig 15.12

Design discharge for two box culverts is estimated to be 249.6 m³/sec, while the flood discharge of the Ubungo River 73.6 m³/sec. Allowance of the capacity is 3.39 which is sufficient enough for the estimated flood discharge of the River.

(3) **Msimbazi River at New Kigogo Road**

Two box culverts are also existed on the Msimbazi River and they are also recommended to be used for the project road as they are because of the same reasons for the Ubungo River. Extension of box culverts will be made having the same dimension of existing culverts as shown in Fig. 15.12

Allowance of the capacity of box culverts against the flood discharge is 1.40. Design discharge for two box culverts is 535.4 m³/sec, while the flood discharge of the Msimbazi River is estimated to be 381.4 m³/sec.

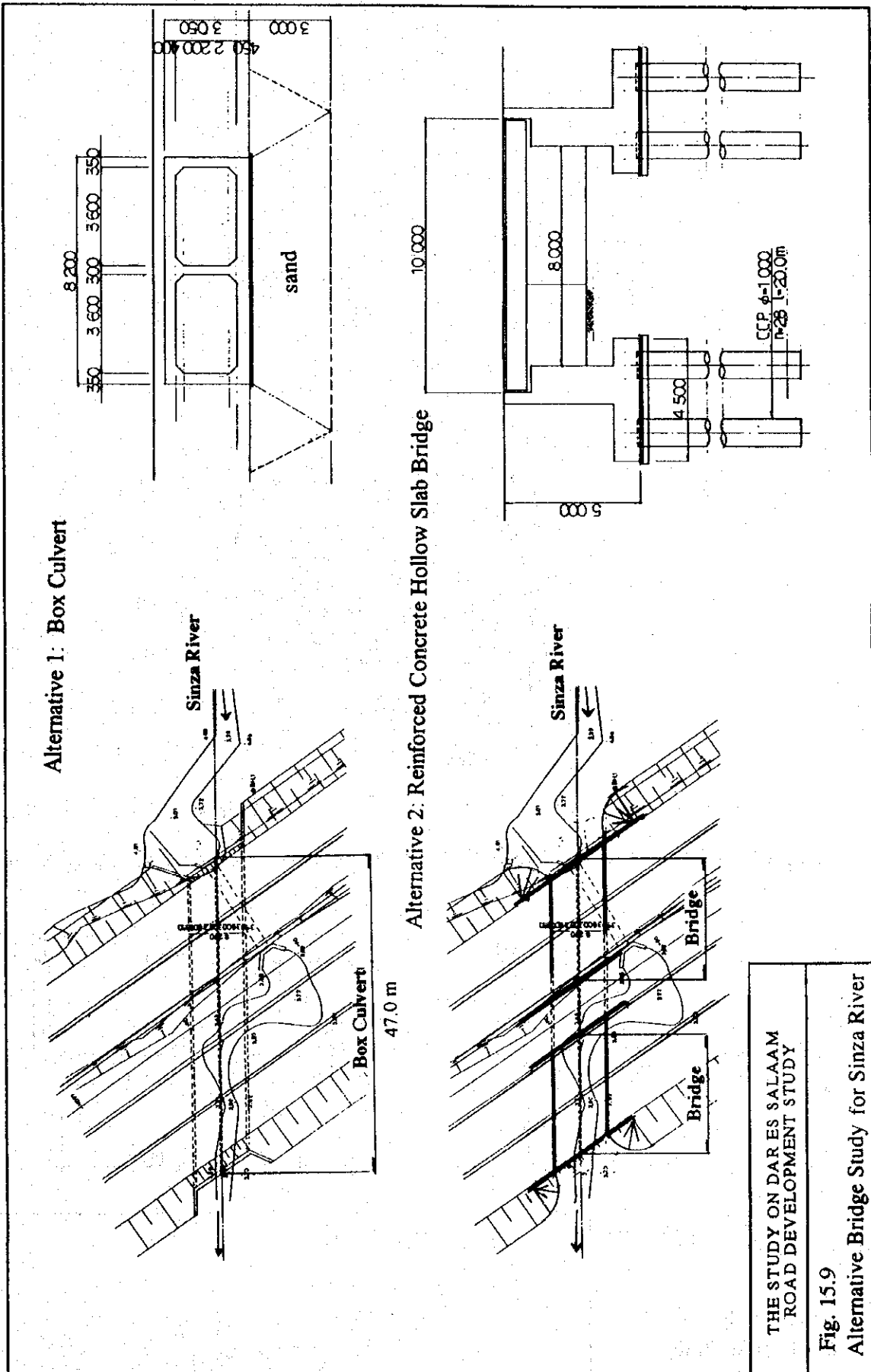
(4) **Other Structures**

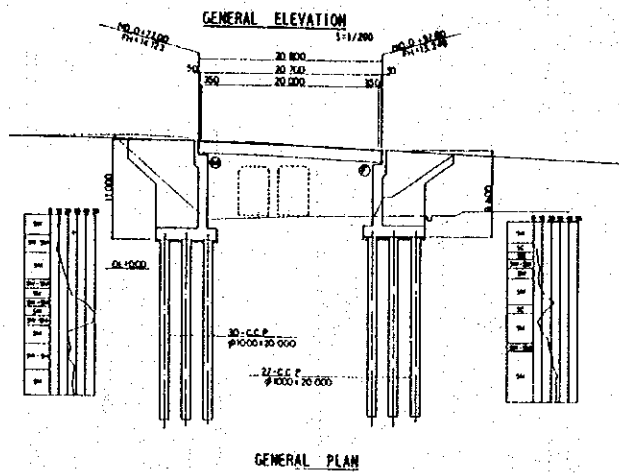
(i) **Retaining Wall for Access Road to Harbor**

The widening of Sokoine Drive will have an adverse effect on the access road to the harbor offices in front of City Hall. 5.5 -7.0 m high L-type retaining wall will be required along the road edge of Sokoine Drive in order to minimize the land acquisition of Harbor facilities.

(ii) **Slope Protection of Kivukoni Front Reclamation**

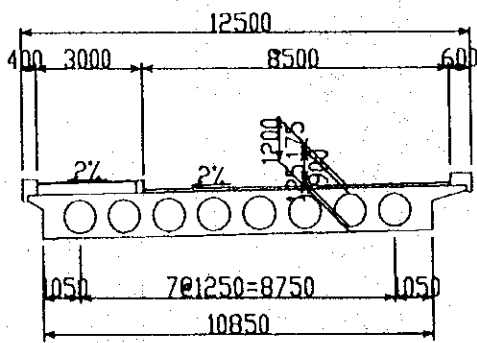
The seashore from the Kivukoni Front up to the Ferry Station is proposed for new bus terminal, car park and seaside promenade as part of the projects for Kivukoni Front and Sokoine Drive. The slope protection should be provided for the reclaimed area to prevent scoring by sea waves and tidal movement.





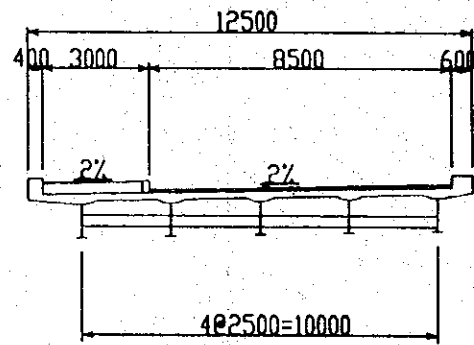
Alternative 1:

Reinforced Concrete Simple Hollow Slab (RC-SH)



Alternative 2:

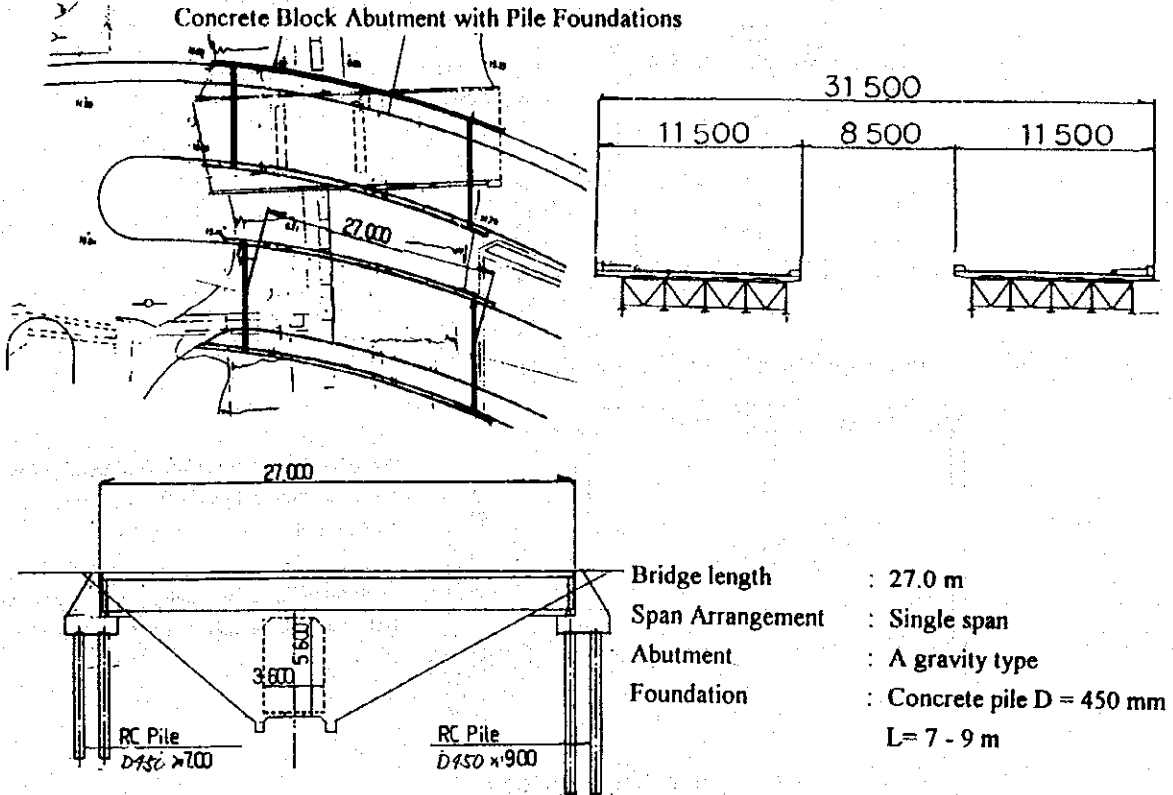
Non-composite Simple Steel Plate Girder (St-Gr)



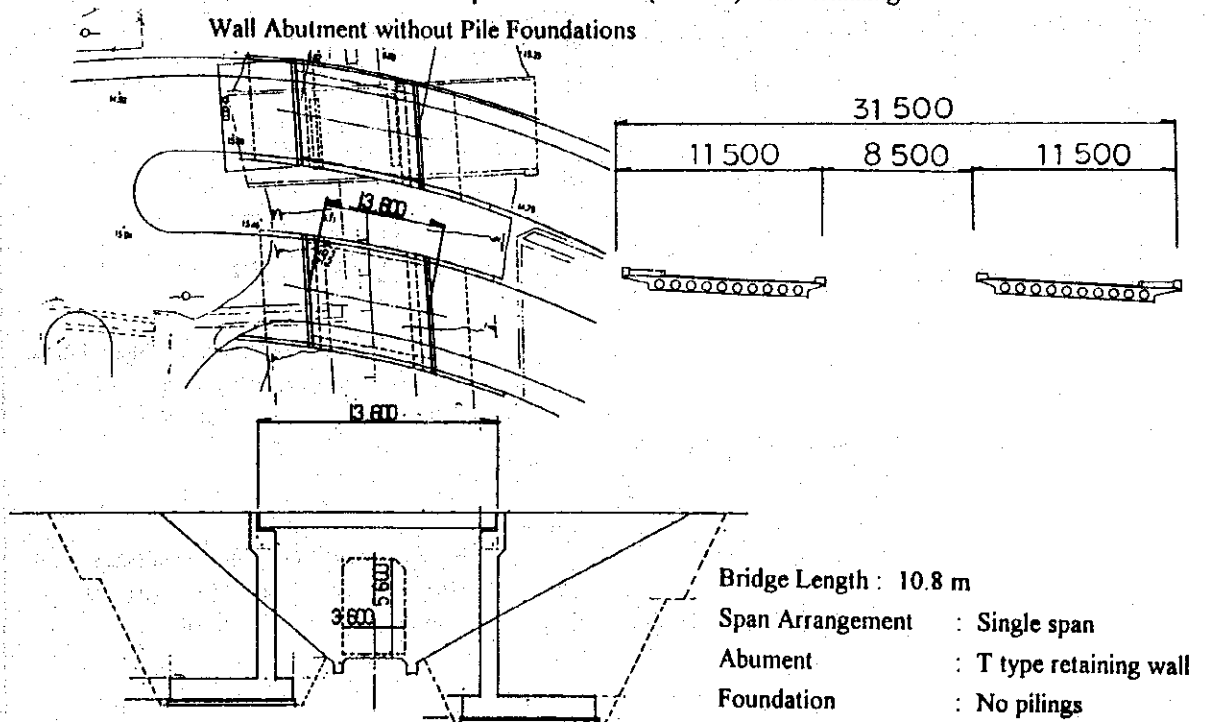
THE STUDY ON DAR ES SALAAM
ROAD DEVELOPMENT PLAN

Fig. 15.10
Alternative Study
for Gerezani Bridge

Alternative 1: Non composite Simple Steel Plate Girder Bridge (St - Gr) with Concrete Block Abutment with Pile Foundations



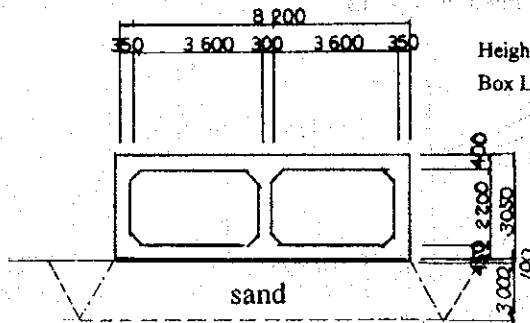
Alternative 2: Reinforced Concrete Simple Hollow Slab (RC-HS) with Retaining Wall Abutment without Pile Foundations



THE STUDY ON DAR ES SALAAM ROAD DEVELOPMENT PLAN

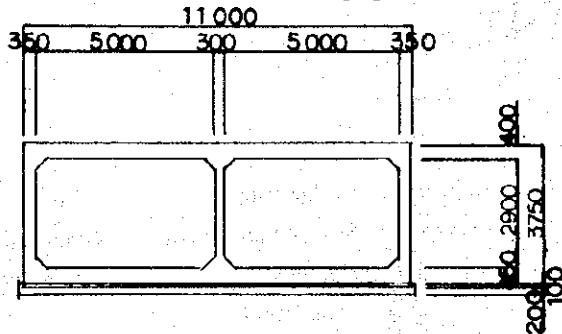
Fig. 15.11
Alternative Study
for Bandari Bridge

(i) Sinza River at Morocco Road



Height x Width x Span = 2.2 m x 3.6 m x 2
Box Length = 47.0 m

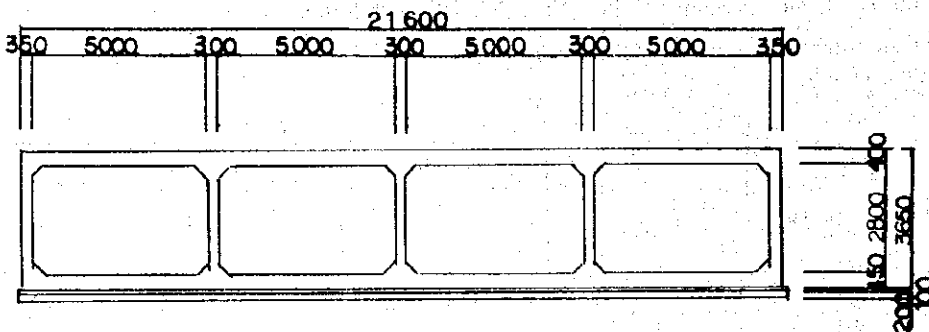
(ii) Ubungo River at New Kigogo Road



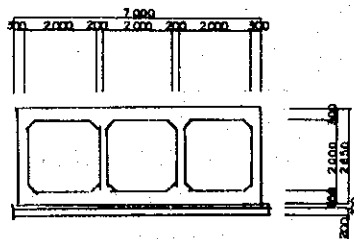
Extension of No. 1 Box Culvert of Ubungo River
Height x Width x Span = 2.9 m x 5.0 m x 2
Box Length = 23.5 m

Extension of No. 2 Box Culvert of Ubungo River
Height x Width x Span = 2.9 m x 5.0 m x 2
Box Length = 24.0 m

(iii) Msimbazi River at New Kigogo Road



Extension of No. 1 Box Culvert of Msimbazi River
Height x Width x Span = 2.8 m x 5.0 m x 4
Box Length = 28.5 m



Extension of No. 2 Box Culvert of Msimbazi River
Height x Width x Span = 2.0 m x 5.0 m x 3
Box Length = 30.0 m

THE STUDY ON DAR ES SALAAM
ROAD DEVELOPMENT PLAN

Fig. 15.12
Typical Cross Sections
of Proposed Box Culverts

15.6 Drainage Design

Drainage structure is one of the most important facilities to keep the road in a safe condition for traffic and to extend the life of the road structure, especially the pavement.

(1) Road Drainage System

The cross slope of the carriageway, shoulders and sidewalks should be sufficient to ensure the rapid drainage of surface water without causing any discomfort or danger to the road users. Surface water shall be collected by U-shaped side ditches and discharged through a pipe or open-lined channels installed on the shoulders so that it will flow to the existing storm drainage systems installed at nearby locations.

(2) Storm Drainage System along the Proposed Road

The functioning of roadside drainage depends on the adequacy of the secondary and primary storm drainage systems. The Study Team conducted the inspection of the existing storm drainage structures along the proposed roads to confirm their working conditions and investigated the necessary improvement measures. The inspection covered outside the right-of-way limits of the proposed road to confirm the flow of water into the existing storm drainage structures.

The following three areas were identified by the Study Team as inundation areas where urgent improvement of the existing storm drainage system is required:

- (i) Inundation Area No.1: The area along the Kijitonyama River between New Bagamoyo Road and Old Bagamoyo Road**

Recommended improvement measures are to widen the existing channel with a lining of concrete block walls which may require Tsh. 164 million approx.

- (ii) Inundation Area No. 2; The area along the Sinza River near Morocco Road**

Recommended improvement measures are the replacement of the existing pipe culverts by box culverts to enlarge the capacity of water

flow. Protection of the embankment slope with stone masonry or concrete blocks are also required.

(iii) **Inundation Area No. 3: The area along the Gerezani Creek near Bandari Road**

The area along Gerezani Creek surrounded by Bandari Road are low-lands lying near the sea level, so that inundation often takes place at high tide, especially during the rainy season. One of the possible measures is to raise the elevation of the low-lands in the area by 2 to 3m. The required cost for improvement is estimated to be about Tsh. 1,900 million.

The preliminary design for the improvement measures recommended for the Inundation Area No.2 is included in the Study because the expansion of the existing drainage capacity is urgently needed and essential for Morocco Road.

Inundation Areas No. 1 and No. 3 are excluded from this Feasibility Study because the existing storm drainage facilities to be improved are basically outside of the proposed roads and improvement measures in terms of construction cost and period are too excessive to include in the road construction project. Instead, these should be incorporated into a river improvement or storm drainage improvement project to be implemented in parallel with the road construction.

15.7 Pavement Design

(1) Selection of Pavement Type

Pavement structures are broadly divided into two types: namely, flexible pavement (asphalt) and rigid pavement (concrete). Considering the construction economy and local conditions, flexible pavement is recommended for the proposed roads.

(2) Alternatives of Pavement

Two types of flexible pavement have been considered under alternative study: Double Bitumen Surface Treatment (DBST) and Asphalt Mixed Concrete (AMC).

Although AMC pavement requires a higher initial investment, it is recommended to be used for this Project because the proposed roads are urban trunk roads with high design standards and carrying heavy vehicles.

(3) Thickness Design

The preliminary thickness design of flexible pavement was carried out in accordance with the "MANUAL FOR ASPHALT PAVEMENT, 1989" published by the Japan Road Association. The Japanese method of asphalt pavement design is largely based on the domestically developed technology incorporated with the principles of AASHTO Road Test and the CBR Design Curve method.

The thickness and the structure of individual layers of pavement were designed based on a comprehensive judgment of various factors including the subgrade, estimated future traffic volume of heavy vehicles, climate conditions as well as economic aspects.

Two alternative pavement structures have been considered for the proposed roads: Mechanically stabilized base course and Cement stabilized base course.

As stated in Chapter 14, the hard rock reserves near Kunduch Beach are running short due to the great demand for roads and house/building construction projects in the Dar es Salaam Region. Therefore, the hard rock materials to be used for base course are expected to be soon short supply and the price of rock will increase by considerable amount in the future.

Although mechanically stabilized base course is most advantageous in terms of construction cost estimated at the present value, cement stabilized base course is recommended considering the shortage of hard rock materials.

Table 15.2 shows the optimum pavement structures recommended to be applied for the proposed roads.

(4) **Overlay Pavement**

In order to reduce the Project cost, the existing road should be utilized as much as possible, providing the road conditions have been reasonably maintained and are in good condition.

Pavement overlays have been proposed for some sections of the proposed roads where reconstruction of pavement or overlay work was previously done under the Japanese Grant Aid Program for the "Dar es Salaam Road Improvement and Maintenance Project", referred to as DRIMP.

The required thickness as well as the exact locations of overlay should be determined on the basis of a detailed subsoil investigation which should be conducted during the next detailed design stage.

The overlay may require either strengthening of the pavement structures to meet the requirement for the anticipated future traffic demand, or to adjust the elevation of the existing pavement to the height of the proposed road. In this Study, the thickness of the overlay is assumed to be 10 cm for cost estimation purposes.

(5) **Pavement Structure of Sidewalks**

The pavement structure to be applied for the sidewalk will be the simple pavement with a 3 cm thick bituminous surface course and a 10 cm thick base course (stabilized gravel).

Table 15.2 Optimum Pavement Structures of Each Proposed Road

Unit : cm

Proposed Roads	New Construction or Reconstruction of Pavement							Overlay Section	
	Type of Pavement	Total Pavement Thickness (cm)	Components of Pavement Structure (cm)				Subbase Course		Surface Course
			Surface Course	Binder Course	Base Course	Subbase Course			
1 Package 1: Arterial Roads in the City Center									
- Ohio Street	Type I-2	45	5	5	10	25	Max. 10	Premixed Hot Asphalt	
- Kivukoni Front	Type I-2	45	5	5	10	25	Max. 10	Premixed Hot Asphalt	
- Sokoine Drive	Type IV-2	75	5	10	25	35	Max. 10	Premixed Hot Asphalt	
- Gerezani Street	Type II-2	60	5	5	20	30	Max. 10	Premixed Hot Asphalt	
- Bandari Road	Type IV-2	75	5	10	25	35	Max. 10	Premixed Hot Asphalt	
2 Package 2: Middle Ring Road									
- Morocco Road	Type IV-2	75	5	10	25	35	Max. 10	Premixed Hot Asphalt	
- New Kigogo Road	Type III-2	70	5	5	25	35	Max. 10	Premixed Hot Asphalt	
- Chang'ombe Road	Type III-2	70	5	5	25	35	Max. 10	Premixed Hot Asphalt	
- Missing Link	Type III-2	70	5	5	25	35	Max. 10	Premixed Hot Asphalt	
3 Package 3: Radial Trunk Road									
- New Bagamoyo Road	Type II-2	60	5	5	20	30	Max. 10	Premixed Hot Asphalt	
- Uhuru Road	Type V-2	85	5	10	30	40	Max. 10	Premixed Hot Asphalt	
- Kilwa Road	Type III-2	65	5	5	25	30	Max. 10	Premixed Hot Asphalt	

15.8 Road Facilities Design

15.8.1 Pedestrian Crossing and Promenade

(1) Pedestrian Crossing

At-grade zebra crossings, either signal controlled or uncontrolled, will be provided at major intersections and busy streets at appropriate intervals. The exact type and location of the at-grade crossings shall be determined during the detailed design stage.

No underpass (by means of box culvert) has been planned because of the problems of security, maintenance for drainage and required lighting.

Pedestrian over-bridges are effective for the safety of pedestrians as well as for streamlining traffic at busy intersections and streets ;however, they were not recommended in this Study because (i) pedestrian bridges across 4-lane roads with wide median strips would require a fairly large amount of construction cost, (ii) it is not advantageous to the physically handicapped or those who are carrying heavy luggage, cyclists and push carts, and (iii) it may not be so sightly and could sometimes act as an obstruction to the future development of the road facilities.

(2) Promenade

A spacious promenade will be provided along the seaside of Kivukoni Front to improve the environment of seashore. Presently, many kiosks are located alongside the seashore which may sometimes interfere with the pedestrian movement and detract from the seaside scenery along the harbor.

The promenade shall be extended along the Kivukoni Front up to the fish market located at the northern tip of Harbor taking into account the convenience of pedestrians and non-motorized people.

15.8.2 Bus Stops, Bus Bays and Bus Stations

Bus service is the main means of public transport in Dar es Salaam and as such special attention should be paid to the design of bus service facilities.

(1) Bus Stops and Bus Bays

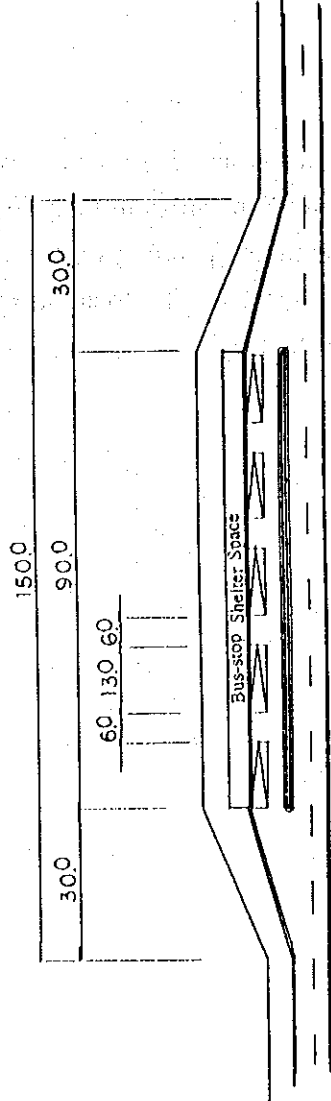
For all trunk roads that carry large volume of traffic at a high speed, the provision of bus bays at regular intervals is essential for maintaining a steady traffic flow as well as for operating bus services smoothly and efficiently.

Since the proposed roads are now being utilized for the major bus service routes, bus bays should be properly provided. Two types of bus bays have been considered depending on the number of bus users. The actual location of the bus bays shall be determined after holding discussions with the agencies concerned.

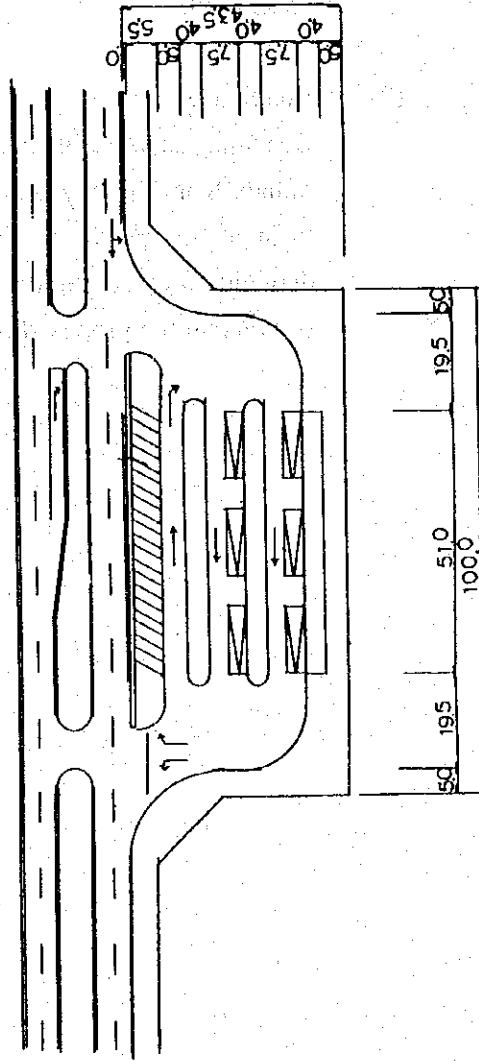
(2) **Bus Station**

Bus stations were planned at the major road junctions where many services radiate from the city center so as to ensure smooth transit from long-distance to local bus services. Two types of bus stations (depending on the future demand) are recommended as shown in Fig. 15. 14. The location of bus stations on the proposed road are shown in Fig. 15.15.

TYPE B : BUS STATION



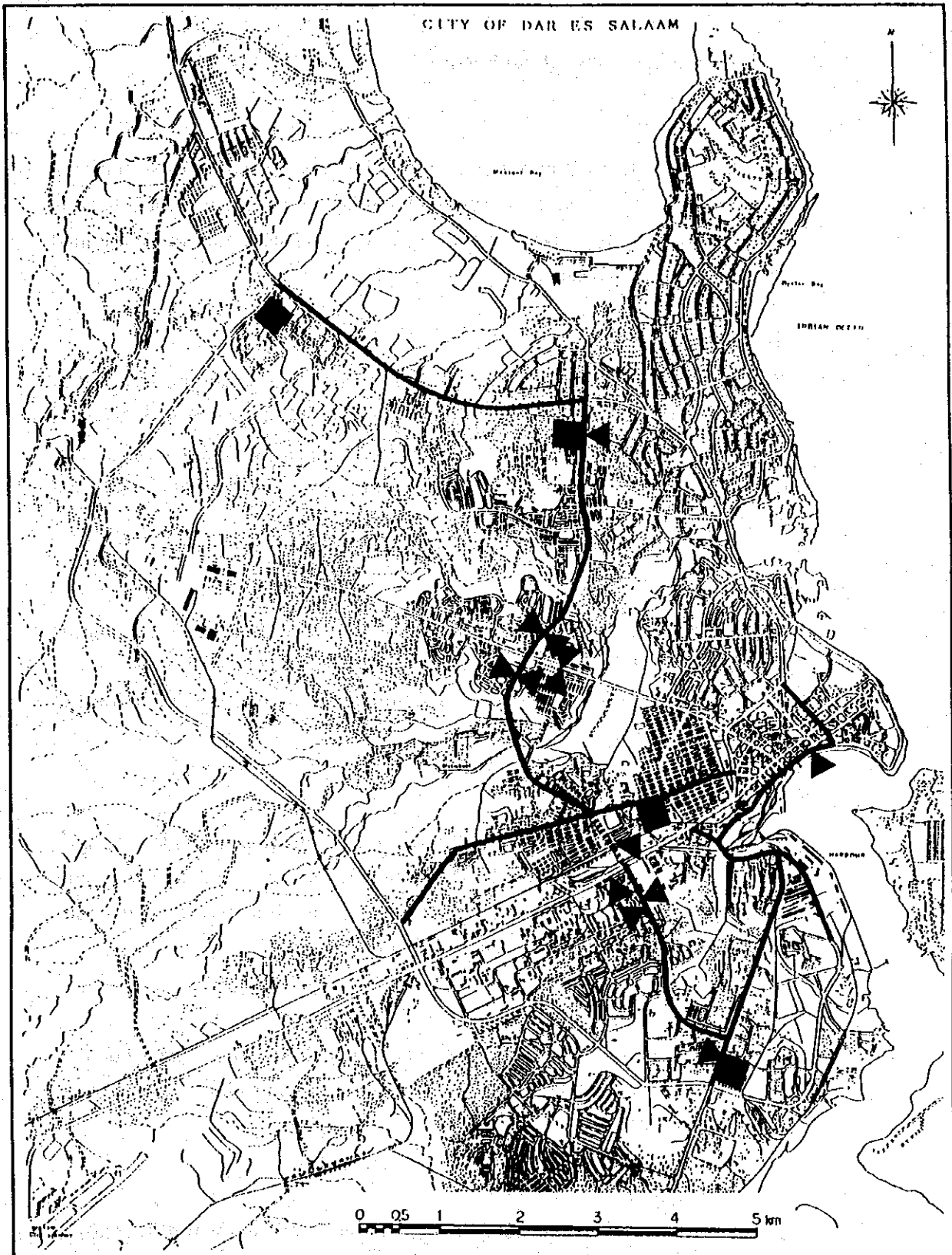
TYPE A : BUS AND TAXI STATION



THE STUDY ON DAR ES SALAAM ROAD DEVELOPMENT PLAN

Fig. 15. 14

The Layouts of Bus Stations



THE STUDY ON DAR ES SALAAM
ROAD DEVELOPMENT PLAN

Fig. 15.15

Location of bus stations

Type A ■
Type B ▲

15.8.3 Lighting and Other Road Facilities

(1) **Lighting Facilities**

Lighting facilities will be provided alongside the proposed roads including intersections. The number of lighting columns, mounting positions, heights of luminaries and the degree of road surface luminance should be determined during the detailed design.

(2) **Traffic Signs**

Warning signs, restriction signs and information signs should be installed at proper locations so as to allow ample time for any necessary action of the vehicle drivers. The types and dimensions of the signs will be finalized during the detailed design and should conform to statutory regulations of the authority concerned.

(3) **Guardrails**

The guardrails will be provided at busy roads, especially the major intersections, for preventing heedless walking and running into the carriageway. The location will be determined taking into consideration the roadside conditions.

(4) **Right-turn Lanes**

In principle, storage lanes for right-turning traffic should be provided at major intersections of the project roads. The storage lanes will be constructed within the width of median strip if sufficient and be designed as full-width deceleration lanes with an end taper of 30 m.

(5) **Carriageway Markings**

Carriageway markings should be used not only to define traffic lanes but also to guide vehicles at junctions and indicate the position of bus stops, waiting lanes and parking bays.

15.8.4 Traffic Signals

Traffic signals shall be installed at at-grade intersections for traffic control, safety of drivers and smooth handling of the traffic flow. They must be designed to meet peak conditions with appropriate reserve capacity, taking into consideration the traffic volume, turning movement for each peak period and estimated growth rate of traffic.

15.9 Relocation and Protection of Public Utilities

The existing utilities were investigated by the Study Team referring to the available data obtained from the authorities and agencies concerned.

Public service utilities, either underground or overhead, are planned to be installed at sidewalk or shoulders so that repair and maintenance operations for the services will not hinder traffic and not accelerate the deterioration of the road structures after they are opened to traffic. The shoulders and sidewalks will provide the space to contain the following public utilities:

- (i) Water main and distribution pipes
- (ii) Electric wires and poles
- (iii) Telecommunication lines

All utilities to be affected by the construction of the proposed roads must be relocated and replaced or protected. Normally, the authorities or agencies concerned are responsible for the relocation and replacement of electric facilities, telephone cables, water mains at their own cost.

15.10 Preliminary Right-of-way (ROW) Design

The ROW limit lines for the proposed roads were indicated in the plans showing the road facilities which are compiled in the separate volume of Drawings.

The ROW plan was made in accordance with the basic concepts established by the Study Team as stated in Chapter 13.

CHAPTER 16 CONSTRUCTION PLAN AND COST ESTIMATE

16.1 General

The Project is composed of three packages as shown below.

Package 1: Widening to 4 lanes of the Arterial Roads in the City Center, (total length of 5.4 km).

Package 2: Widening to 4 lanes of the Middle Ring Road with construction of the Missing Link, (total length of 9.9 km).

Package 3: Widening to 4 lanes of the Radial Trunk Roads, (total length of 11.6 km).

16.2 Conditions Affecting the Construction Sites

The construction plan and cost estimates have been made taking into considerations the weather conditions, natural material sources, availability of local materials and equipment, abandoned ships in Dar es Salaam Harbor, relocation of TRC (Tanzanian Railway Corporation) railway line, relocation of public utilities and traffic management during the construction.

16.3 Unit Costs and Work Quantities of Major Work Items

The unit costs of equipments, materials and labor were calculated using the July 1994 price for each work item based on the construction schedule and method, local conditions, availability of local products, combination and workability of equipments, quantity of equipments and materials and labor to be used.

Work quantities were calculated on the basis of the preliminary design.

16.4 Estimated Construction Costs

The construction cost was estimated for each project road using the July 1994 price.

The compensation of houses/buildings and replacement of public utilities were also calculated on the basis of the current standard unit rates applied by DCC (i.e. in the local currency component). In Tanzania, private ownership of land is not allowed and thus all the land belong to the government.

16.5 Summary of the Project Costs

Table 16.1 shows the Project costs by currency components including construction cost, compensation cost for houses/buildings, physical contingency and price contingency as well as the engineering costs for the detailed design and construction supervision.

16.6 Maintenance Cost

Road maintenance costs, which are required after completion of the Project, are divided into two categories as follows:

- Routine maintenance
- Periodic maintenance

(1) Routine Maintenance Cost

Routine maintenance consists of the operating cost, cleaning cost and repairing cost. The average annual routine maintenance cost spent by the City Council of Dar es Salaam in the past few years is roughly estimated at Tsh. 350,000 per km for a 2-lane road. After widening, it is estimated that the cost will increase by about 50 % to Tsh. 525,000 per km for a 4-lane road.

The total routine maintenance cost for the project roads having a total length of 28 km is calculated to be: Tsh. 525, 000 km/4-lane x 28 km = Tsh. 14,700,000/year

(2) Periodic Maintenance Cost

Pavement design is usually made covering a period of five years after completion of the Project so as to reasonably reduce the initial investment. This assumes that the periodic maintenance by overlay will be made at appropriate intervals to cope with the increased traffic volume.

In this Study, an overlay (5 cm of asphalt concrete) is planned to be done at five-year intervals assuming that the Project will be completed in 2000. Two times of overlay will be done in 2005 and in 2010. The required cost of the overlay for a 4-lane road is estimated to be Tsh 2,548,000,000 every time.

(3) Economic Maintenance Cost

The economic maintenance cost which is to be used in the economic evaluation of the Project, shall exclude tax and duties; it is equivalent to 90 % to the above maintenance cost.

Table 16.1 Summary of Project Costs

Unit : Tsh. 1,000

No.	Description	Amount		Total
		Foreign Portion	Local Portion	
A. Construction Cost				
P-1 Arterial Roads in the City Center				
	Ohio Street	544,797	98,153	642,950
	Kivukoni Front	552,949	138,934	691,883
	Sokoine Drive	547,291	143,057	690,348
	Gerezani Street	674,197	145,072	819,269
	Bandari Road	2,262,798	552,712	2,815,510
	Total (1)	4,582,032	1,077,928	5,659,960
P-2 The Middle Ring Road				
	Morocco Road	3,677,255	828,762	4,506,017
	New Kigogo Road	2,811,120	694,498	3,505,618
	Missing Link	723,691	126,188	849,879
	Chang'ombe Road	1,865,656	401,143	2,266,799
	Total (2)	9,077,722	2,050,591	11,128,313
P-3 Radial Trunk Road				
	New Bagamoyo Road	4,351,302	740,418	5,091,720
	Uhuru Road	2,297,362	520,547	2,817,909
	Kilwa Road	2,976,528	534,214	3,510,742
	Total (3)	9,625,192	1,795,179	11,420,371
	Total (1) + (2) + (3)	23,284,900	4,923,700	28,208,600
B. Engineering Cost				
	Detailed Design & Supervision (10% of Const. cost)	2,328,500	492,400	2,820,900
C. Contingency for Price Escalation and Physical Change				
	(10% of Const. cost)	2,328,500	492,400	2,820,900
D. Government Administration Cost				
	House Acquisition Cost	-	481,600	481,600
	Admi. Cost (1% of Const. cost)	-	282,100	282,100
	Grand Total (A)+(B)+(C)+(D)	27,941,900	6,672,200	34,614,100

Exchange Rate: US\$ 1.0 = Tsh. 530.0 = ¥ 100.0 (As of July, 1994)

16.7 Maintenance System and Operation

16.10.1 RMMS

The manual entitled "Road Maintenance Management System (RMMS)" was prepared by the former Ministry of Works and became effective on July 1, 1991. The RMMS was introduced to maintain uniform national standards, procedures and work methods, as well as to produce guideline priorities for the regional maintenance work program.

16.10.2 Technical Issues on Maintenance Work

(1) Special Care for Roadside Drainage Structure

The ground condition around Dar es Salaam city is basically sandy. Blocking of steel gratings by soil have frequently brought about flooding along the roadside areas. A routine maintenance should be undertaken properly and timely, including (i) cleaning the blocking of gratings and removing sedimentation in the roadside drainage structures, (ii) removing the sand heaped along the road and sidewalks, and (iii) removing the mud in the channel by dredging or other methods.

(2) Improvement of Storm Drainage System

As discussed in Section 15.6 (Drainage Design), Chapter 15, the need for the improvement and maintenance of storm drainage system is a serious problem which needs to be solved. The improvement measures should be undertaken with the development plan of other sectors being incorporated, especially road sector, to minimize the investment amount and environmental effects.

(3) Destruction of Pavement by Private Works

Approx. 20 km of major roads in Central Area were rehabilitated and improved under the improvement project of DRIMP, Phase 1 in 1991- 1992.

However, some of the pavements of these roads are already damaged in several places by installation of water supply and sewerage pipes incidental to the construction of buildings alongside the road. These damaged pavements are usually left for a long time without any repair which results in an increase of pavement deterioration as well as the cause of serious traffic accidents.

An emergency repairing system for such type of destruction should be established with a penalty being applied against persons responsible for repairs.

16.10.3 Maintenance Management System

(1) Jurisdiction of MWCT and DCC on Maintenance Work

The road classification (trunk road, regional road, etc.) has not been applied to the road network system in Dar es Salaam strictly in accordance with the Draft Road Manual framed by MWCT in 1989.

The classification of the road network system as well as the jurisdiction of maintenance responsibility should be clarified taking into account the urban and city roads in the Dar es Salaam Region. This is needed for establishing an efficient road maintenance management system (RMMS) in the City.

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

The maintenance units of the DCC have been enlarged under DRIMP since 1991 with financial assistance from the Japanese Government. Also, a new main depot was established as the DRIMP Office in Ilala Garden near junction of Uhuru and New Kigogo Roads.

In the meantime, 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 this kind of contract maintenance, however, will need a sufficient transition period due to lack of resources and maintenance experience of local contractors.

The Study Team recommends to develop the DRIMP Office as a road 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 requirements in the MWCT's policy but also to encourage maintenance by contract.

The DRIMP Office has already been provided with a minimum facilities for periodic and routine maintenance, so that additional equipment and facilities required for the on-the-job training will be a training room with computer facilities, workshop with instruments and store room for materials.

Since training is essential for improving the performance of the maintenance personnel at all levels, the procedures and standards of the RMMS must be fully understood and effectively executed.