No.

Dar es Salaam City Council

The United Republic of Tanzania

Dar es Salaam

Transport Policy and System Development

Master Plan

Pre-Feasibility Study Report

Vol. I Gerezani Area Transport Enhancement Project

June 2008

JAPAN INTERNATIONAL COOPERATION AGENCY

PACIFIC CONSULTANTS INTERNATIONAL

CONSTRUCTION PROJECT CONSULTANTS

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Chapter 1 Project Orientation

The Gerezani area is located approximately south/southwest of the Dar es Salaam CBD. Bandari Intersection (Kilwa Road, Bandari Street) is an identified key intersection (**Figure 1.1.1**).

Kilwa Road is being widened over a distance of approximately 11 kilometers extending south of its northern terminus at Bandari Intersection. The improved cross-section will consist of four mixed traffic lanes (two in each direction), with sufficient median reserve to accommodate a future two-lane BRT busway. The project is sponsored by the Government of Japan and due for completion by March 2009.

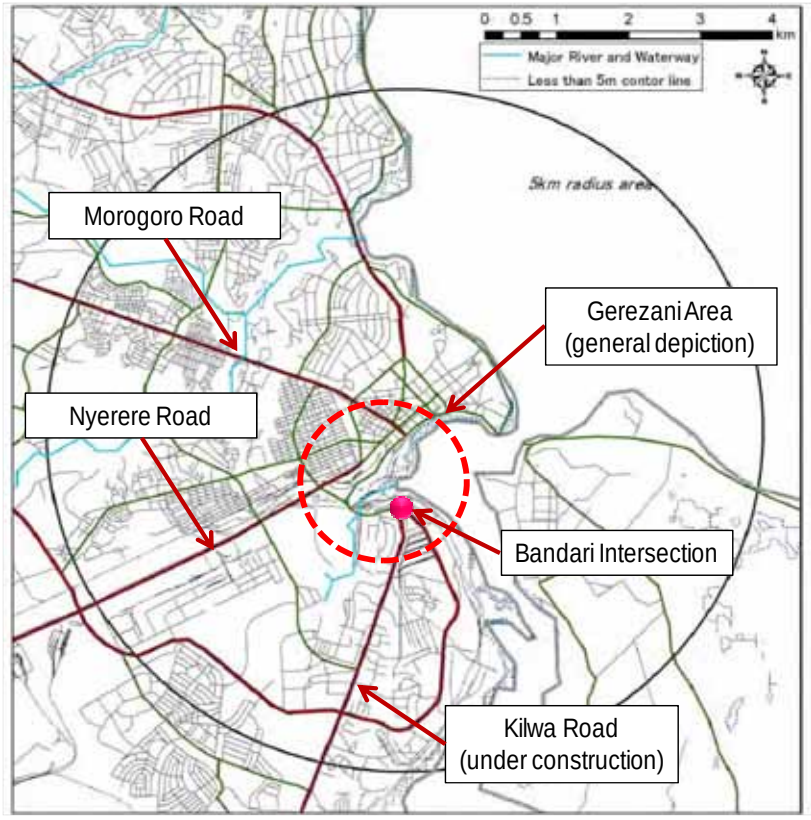


Figure 1.1.1 Locations of Gerezani Area and Bandari Intersection

Under the proposed road functional classification scheme by the Dar es Salaam Transport Policy and System Development Master Plan, Kilwa Road will be designated a Type II Primary Arterial with four mixed traffic lanes, two BRT lanes and at-grade pedestrian crossings to the median BRT stations (see Technical Report 2 for the Master Plan).

No other road improvements are currently programmed in the immediate area. Bandari Road will retain a two lane cross-section. In addition, there are two rail crossings between Kilwa Road and Nyerere Road, one being a bridge (road over rail), the other a disused at-grade crossing. Bandari Road is flanked by various land use developments, and features a right-of-way of 20 meters. Sokoine Drive, also a two-lane road, intersects Bandari Road west of Kilwa Road at the Gerezani Roundabout, from which point it traverses north to the CBD. Sokoine Drive is flanked by intermittent land uses, and has recently been the subject of considerable upgrading of pedestrian walkways and amenities.

The proposed BRT plan by the Master Plan calls for, in addition to the committed Phase I project, three additional future BRT corridors (Nyerere Road, TRL rail corridor, Kilwa Road) in the immediate area as well as major central area BRT stations at Kariakoo, Dar es Salaam City Council (DCC) and the Railway Street rail station (**Figure 1.1.2**). The Kilwa Road system is scheduled for BRT Phase 3 implementation during years 2012 and 2013. This assumes construction of the BRT will take 12 months to complete.

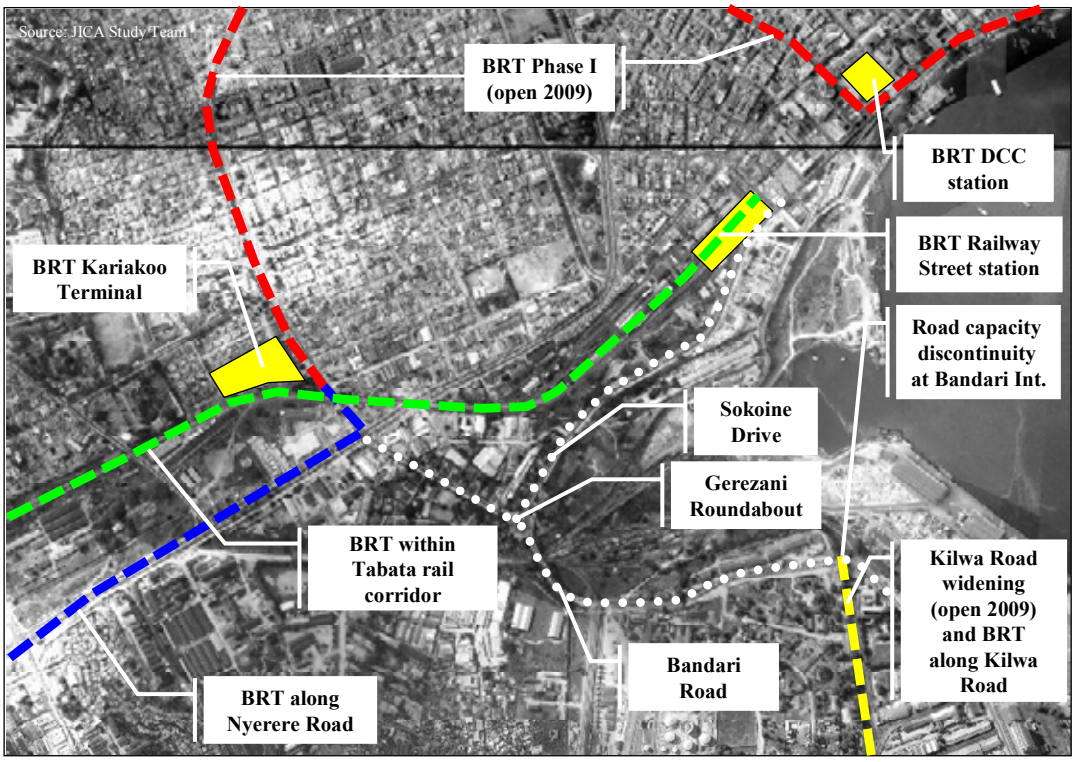


Figure 1.1.2 Major BRT Elements in the Gerezani Catchment

Four core concerns are apparent:

- Bandari Intersection is part of the Kilwa Road widening project. However, current designs call for the termination of the six lane Kilwa Road improvement (four arterial lanes plus two BRT lanes) at the intersection. Bandari Road features a two-lane (one lane per direction) cross-section; resultant quantum changes in capacity are likely to catalyze considerable congestion at Bandari Intersection.
- The Kilwa Road improvement, as noted previously, terminates abruptly at Bandari Intersection. Road system continuity must be established via linkages either to the west (direction Nyerere Road) and/or the north (direction CBD).
- A need to link the Kilwa Road BRT system with other BRT lines, and/or the major BRT stations at Kariakoo, DCC and Railway Street station.
- Any solution must not funnel additional traffic into the CBD, whose intersections and pedestrian systems are already operating at capacity.

Chapter 2 Project Options

2.1 Options for BRT Operation

The resolution of identified concerns in the previous chapter involves three intrinsically interlinked considerations:

- The needs of public transport, which at present (Kilwa Road dala dala activities) average some 4,500 passengers per morning peak hour. The prioritization of public transport, most specifically BRT, is a stated goal of the Master Plan. BRT solutions must therefore be sensitive to efficiency of operation, passenger convenience and bus operational costs.
- A logical, cohesive and balanced road network whose implementation is technically reasonable and financially affordable. Upgrading of roads must be directly integrated with the provision of BRT busways. The solutions impacting roads will clearly involve Bandari Road and Sokione Drive; however, a further option is to implement new infrastructure which, in a general sense, resembles a northward extension of Kilwa Road, direction CBD, involving a bridging of the seaport properties.
- Environmental concerns, most directly the fostering of a more pedestrian-friendly ambience within the CBD. This implies that the provision of roads capable of funneling yet more traffic into the CBD should be avoided in light of already existing road capacity constraints.

Four options relating to the operation of BRT have been identified (**Figure 2.1.1**):

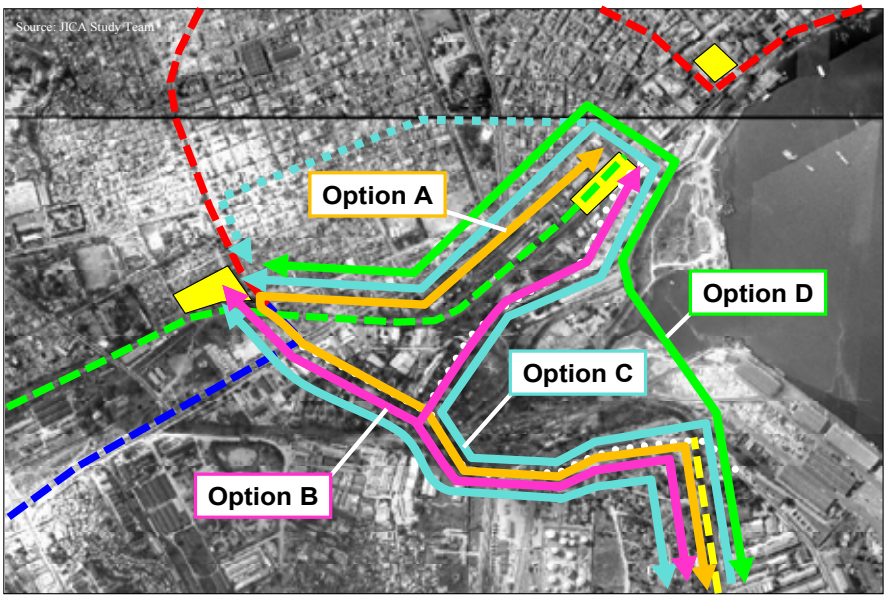


Figure 2.1.1 Alternative BRT Service Options

- Option A is a seemingly logical alternative being to maintain the present Bandari - Gerezani Roads corridor. Widening to manage anticipated volumes of all traffic will be needed. This would be to six lanes, identical to the Kilwa Road upgraded design (four mixed traffic lanes plus median-sited BRT lanes). BRT under Option A operates a two way service to Kariakoo Terminal then joining the TRL BRT corridor to the Railway Street Station. As the BRT will need to cross Nyerere Road a flyover for the exclusive use of BRT will be required. Option A is also the most circuitous BRT route having to "double back" from Kariakoo Terminal to complete the connection to the CBD.

- Option B is a variation where the BRT operation uses two routes, in essence splitting the Option A service concept. One route would operate two-way between Kilwa Road and Kariakoo Terminal, while the second would access the CBD via a Sokoine Drive using a two way BRT.. Physical construction requirements are a six lane road along the Bandari-Gerezani Roads axis and a BRT-only flyover at Nyerere Road (all being identical to the Option A requirement). However, under Option B, there is an additional need to widen Sokoine Drive to 4 lanes to accommodate a two way BRT busway. Thus, while Option B provides a more direct BRT connection to the CBD, there arises a need for additional road lanes in terms of widening Sokoine Drive. There also exists the underlying issue that the BRT busway along Sokoine Drive parallels (and duplicates) the TRL rail line alignment. While this, in itself, is not a major problem, it is a duplication vis-à-vis routings contained in other options.

- Option C is a variant of Option B in that the BRT route operating along Sokoine Drive will operate as a one-way route returning via the TRL BRT busway to Kariakoo Terminal, then joining the Gerezani-Bandari Roads BRT facility to return to Kilwa Road. This in effect operates the BRT to the CBD and then Kariakoo via a one-way counter-clockwise loop. Physical construction requirements are similar as Option A, except that as Sokoine Drive only

needs one lane to accommodate a one-way BRT service no widening is required (just change in road marking/segregation) to dileaste a BRT lane. Changing the route to the opposite direction during peak hour return period) is possible, but can be confusing to passengers and required a high level control system to manage bus operations safely.

- Option D is building an elevated road link across the seaport area for the exclusive use of BRT, with additional lane facilities for pedestrians and non-motorized vehicles. The BRT operation would be direct to the Railway Street station, then joining the TRL BRT line to Kariakoo Terminal. There would be no BRT operating along Bandari Road and Sokoine Drive. Option D, has slightly longer travel time for Kariakoo Terminal passengers in that the bus will first travel to the CBD but should not give the impression of doubling back (as in Option A).

Several additional considerations are noted:

- The new road link crossing (bridging) the port area could be expanded to also carry mixed traffic. However, this is rejected out of hand in that the CBD cannot cope with additional traffic, given that at present already CBD intersections are operating at or near capacity. The mixed traffic link is therefore not compatible with the CBD traffic plan (refer Technical Report 2 for additional discussion).
- A BRT-only flyover across Nyerere Road is a vital requirement for Options A, B and C. Not providing such a facility will be a major constraint to the BRT and other traffic along Nyerere road.
- The BRT service strategy embodies use of the disused TRL rail corridor for BRT service. This corridor, which links the CBD with vicinity of Ubungo Intersections, is an important part of the overall service strategy. If BRT is denied in this corridor, then only the Option C is seen as being viable as it can operate as a one-way service concept along Uhuru Road (dashed line in previous graphic).
- The use of two separate bus routes along Kilwa Road for Options B and C has no service disadvantage as it is not difficult for passengers to differentiate between two routes along Kilwa Road. These can readily be differentiated via different destination boards, or perhaps color schemes. But both options imply an increase in service headways (longer average wait) as only every second bus will travel to any particular destination lying beyond the “route branching point”.

2.2 Integrating Road and BRT Needs

The formulation of a road enhancement strategy is in fact a fusion of BRT needs (in terms of busway) as well as requirements of mixed traffic (hence road widening) due to increasing demand and/or constraints on capacity. A particular concern from the road perspective is the number of lanes discontinuity at Bandari Intersection following completion of the on-going Kilwa Road improvement project. The various road enhancements are presented in following paragraphs; for ease of discussion,

each is identified with a particular BRT option.

- Option A: The core requirement is that Bandari Road will require widening to six lanes (four mixed traffic, two BRT) between Kilwa Road and Kariakoo Terminal, over a total distance of 1.67 kilometers (**Figure 2.2.1**). In addition, a BRT-only flyover across Nyerere Road is needed for this option (also Options B&C). A concept design of the flyover, being in accordance with the 'special roads" categorization of the proposed functional road classification plan, is depicted in **Figure 5.3.3**.
- Option B: has the same road construction requirement as Option A on Bandari Rd, with the addition of two-directional BRT lanes along Sokoine Drive over a distance of 1.45 kilometers. Widening Sokione Rd would be to four lanes, which includes two mixed traffic plus two BRT lanes (**Figure 2.2.2**). A concept design of the Sokoine Drive widening is depicted in **Figure 5.3.4**.

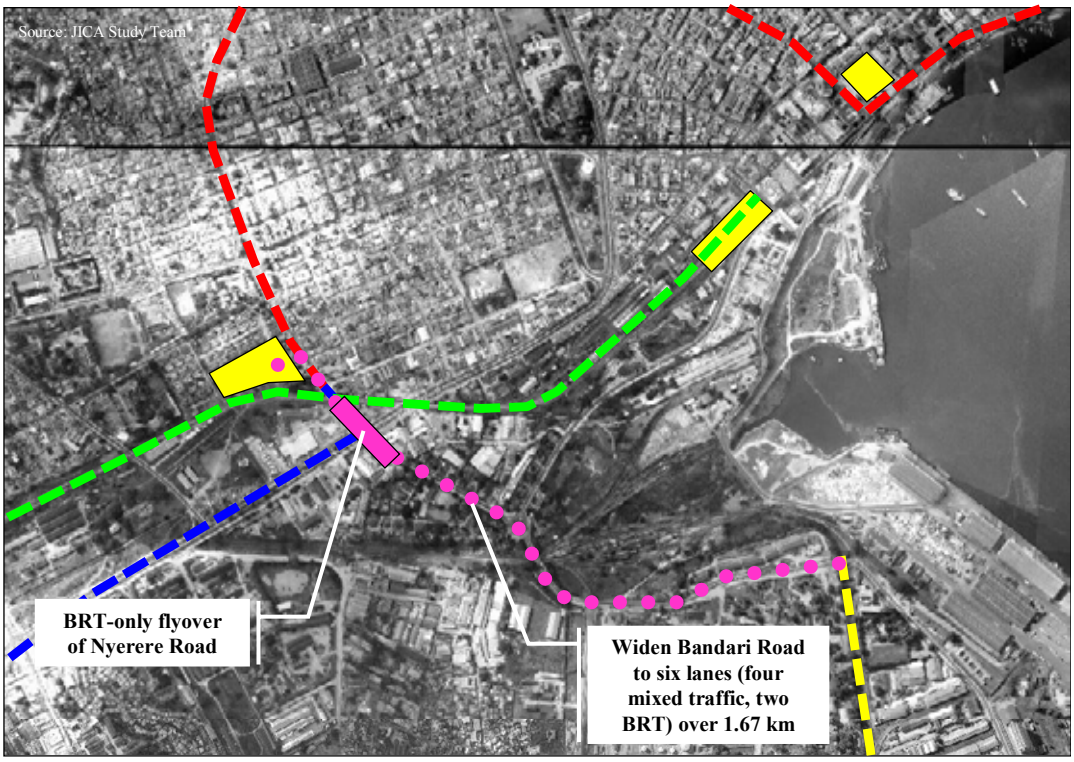


Figure 2.2.1 Road Enhancement Implications: BRT Option A

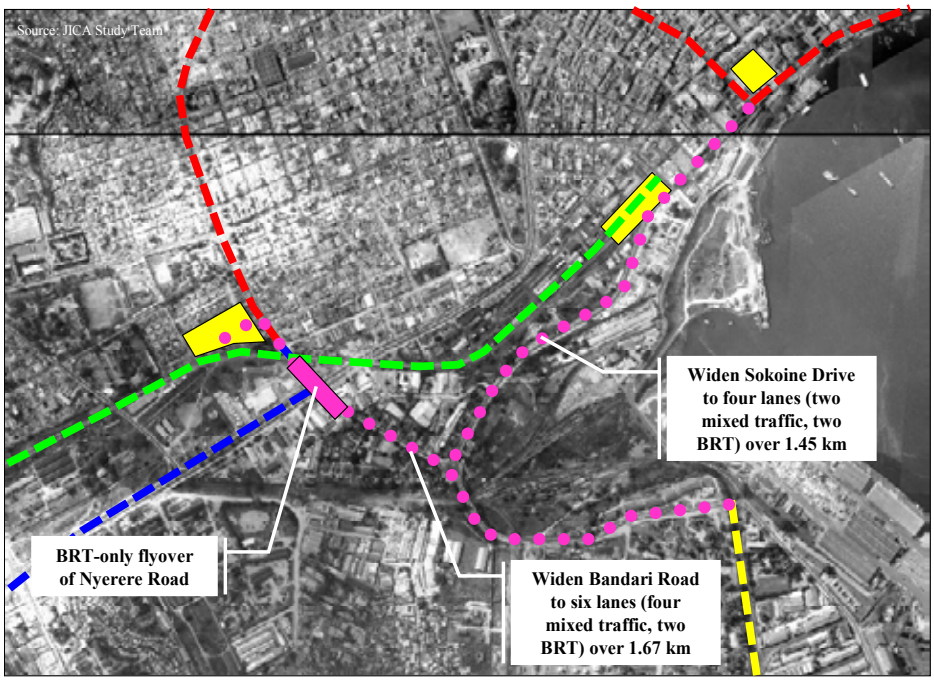


Figure 2.2.2 Road Enhancement Implications: BRT Option B

- Option C: The road implications are identical to those of Option A, with the exception that, due to proposed one-way BRT operation along Sokoine Drive, widening would no longer be needed. Instead, appropriate markings and control, plus possible site-specific BRT priority treatments, would be applied (**Figure 2.2.3**).

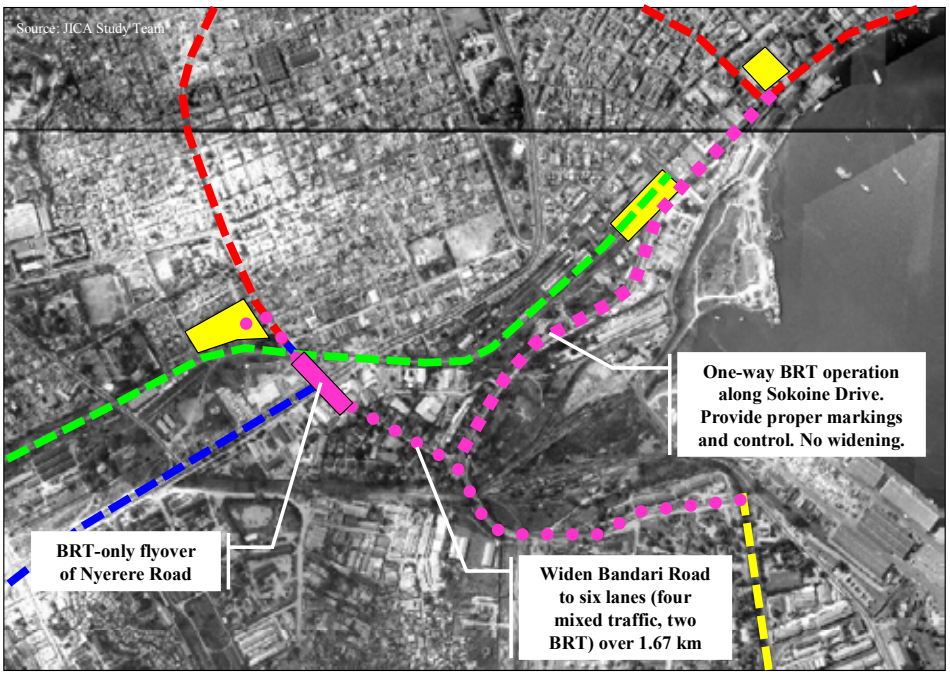


Figure 2.2.3 Road Enhancement Implications: BRT Option C

Option D: This variant provides a more comprehensive (and capital intensive) approach to problem solving. Bandari Road will require widening, but only to four lanes in that the main focus of the improvement is road capacity uniformity; BRT will not operate along Bandari Road. The BRT-only flyover at Nyerere Road, included in the previous three options, will not be required under Option D. The BRT service will instead continue north from Bandari Intersection, bridging port property via a BRT bridge. This facility would, in addition to BRT, also accommodate pedestrians and non-motorized vehicles. Widening of Sokoine Drive north of the bridge terminus will also be needed to accommodate two BRT lanes (**Figure 2.2.4**).

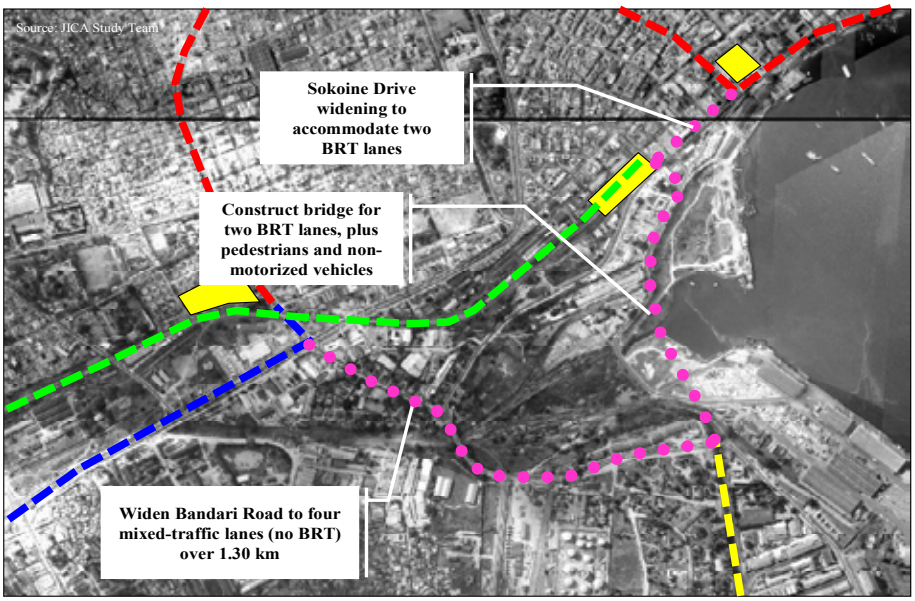


Figure 2.2.4 Road Enhancement Implications: BRT Option D

The conceptual design for the potential facility over-bridging port property is shown in **Figure 5.3.5.**

Chapter 3 Existing Condition of the Project Area

3.1 Topographical Condition

The city of Dar es Salaam was originally developed at the mouth of small bay facing the Indian Ocean, and currently it has been extended along the coast and into the inland area in the west. The major topographical feature of the city originates from coastal geomorphology such as plain, back marsh and terrace. The project area is situated mainly at the coastal Terrace and lowland.

3.1.1 Coastal Terrace

The proposed roads in the Options presented in the previous chapter are in the flat or gentle-slope terrace of 15 to 20 meters in elevation, which was formed by the geological marine backward during the late Pleistocene of geological era (about 10,000 years ago).

3.1.2 Lowland

There is a small creek in Gerezani Area. The project area includes a low land of less than 5 meters elevation in the outlet area of the creek. In the past time, it submerged under the sea and it appears currently on the ground due to geological marine backward. This lowland is located in the tidal range, influenced by the sea level and drain water from the creek is apt to stagnate during the high tide time.

3.2 Hydrological Condition

3.2.1 Rainfall

The **Table 3.2.1** shows monthly rainfall of Dar es Salaam. As shown in table, the season is clearly divided into dry and rainy seasons: June to October is dry and March to May is rainy season respectively. The period from November to February is called as a semi rainy season.

3.2.2 Flood

In the Gerezani creek, flood often occurs in the rainy season and outlet zone of the creek is soaked. In

the existing road, box culvert for drain chokes up with increase of sediment, and water flow stops frequently. This situation becomes conspicuous during high tide time, because its location is close to the sea and influenced by tide level. Discharge capacity of flood flow is estimated at 20 m^3/sec by the size of existing drainage channel (10 m wide x 2 m high x 1 m flow velocity).

Table 3.2.1 Monthly Rainfall of Dar es Salaam City

Month	Rainfall (mm per month)	Rainy day (day per month)	Season Classification
Jan	81.8	7	Semi Rainy Season
Feb	59.4	5	Semi Rainy Season
Mar	130.4	12	Rainy
Apr	263.3	19	Rainy
May	178.9	13	Rainy
June	37.3	5	Dry
July	28.8	5	Dry
Aug	26.5	4	Dry
Sep	26.1	5	Dry
Oct	60.0	6	Dry
Nov	12.8	8	Semi Rainy Season
Dec	119.6	7	Semi Rainy Season

Source: Statistical Abstract 2002, Nation Bureau of Statistics (2003)

3.3 Geotechnical Condition

The geological base of Tanzania is Pre-Tertiary layer associated with Quaternary volcanic layers of which distributed in the mountain range along the tectonic zone in the continent.

The project area is located close to the coastal line and its layer base is consisted of late quaternary limestone which origin is the uplifted coral reef.

A boring investigation study which was conducted for Dar es Salaam Road Development Plan Study (JICA 1995) is available at the relevant three locations (**Figure 3.3.1**). The depth of boring drilled was 20 meters in each. Based on this study **Table 3.3.1** summarizes geotechnical conditions of Kivukoni Sea Front, Gerezani Creek and Bandari Bridge areas.

(1) Kivukoni Sea

The location is close to shoreline and of which surface is covered by beach sand with clay. Crushed coral sand deposits up to 14 m deep and it is transferred into coral limestone layer regarded as a bearing one for pile foundation.

(2) Gerezani Creek

As described in section 3.1, the area is a low land facing the sea. The ground surface is composed of soft clay with 4 m thickness. Up to 20 m depth, loose and medium stiff sand layers are deposited. Expected depth of bearing layer for pile foundation is 30 m, although the boring was not drilled into below 20 m.

(3) Bandari Bridge

The location is on the coastal terrace about altitude of 20 m above the sea level, and its subsoil consists of sand and gravel of coral origin. According to the JICA study in 1995, hard coral boulders were found between 6 and 14 m depth and it is transferred to stiff sand.

Friction pile 15 m long was installed in the stiff sand layer appropriately. In case that boulder 6 to 14 m depth is in the coral limestone layer, direct footing foundation becomes possible.

(4) New Port Crossing Bridge for Option D

A new bridge is planned crossing the Dar es Salaam port yard. The bridge alignment runs in a lowland area of Gerezani creek, accordingly its geotechnical condition is same as the bridge crossing the Gerezani creek. Loose sand deposits thick and bearing layer for pile foundation probably underlies below 30 m in depth.

Table 3.3.1 Geotechnical Condition in the Bandari and Kilwa Road

Location	Depth(m)	Soil Type	N-Value of S.P.T	Hardness Stiffness	Recommendable Foundation
1 Kivukoni Sea Front	0 to 5 5 to 14 14 to 20	Sand/Clay Sand Coral (Limestone)	0 to 5 10 to 20 Over 50	Soft Medium Very Stiff	 End bearing pile 15 m
2 Gerezani Creek	0 to 4 4 to 12 12 to 20	Clay Sand Sand	0 to 5 7 to 15 15 to 20	Very Soft Loose Medium Bearing Layer Assumed 30 m	 End bearing Pile or Friction Pile 30m
3 Bandari bridge	0 to 6 6 to 14 14 to 20	Sand Sand Boulder mix Sand	10 to 20 20 to 30 30 to 50	Medium Stiff Stiff	 Footing or Friction pile 15m

Source: Dar es Salaam Road Development Plan, JICA, 1995

Source: Dar es Salaam Road Development plan JICA.1995

Figure 3.3.1 Locations of Boring Investigation

Chapter 4 Traffic Study

4.1 Current Traffic Demand

There are three sources to understand the traffic demand in the project area: Dar es Salaam Road Development Plan (JICA, 1995), Detailed Design of Upgrading of Kilwa Road (JICA, 2004) and this study (as of June 2007) as shown in **Table 4.1.1**. The traffic volume of Bandari road has increased slightly in the last ten years, but actually the difference between 1993 and 2007 is small. The traffic volume of Kilawa has decreased because of the current construction work: the GOJ sponsored widening project. After completion of this widening project a significant increase of vehicular traffic is expected from the southern part of Kilwa road.

Table 4.1.1 Traffic Count Results in/near Gerezani Area

Road	Date of Traffic Survey	Surveyed Point	Name of Study	Survey Result	Survey Condition
Bandari road					
1	11/11/1993	Unknown	Study on Dar es Salaam Road Development plan , 1995 by JICA	14,900	12 hours, excluding motorcycle
2	28/06/2007	BP depot entrance	This study	17,700	14 hours from 6:00, excluding motorcycle
Kilwa road					
1	15/07/2004	Temeke junction	Detail design of upgrading of Kilwa road, 2004 by Black & White consultant of south Africa	17,200	16hours from 6:00 excluding motorcycle
2	12/08/2005	Temeke junction	Basic design study for widening of Kilwa road, 2006 by JICA	15,600	14 hours from 6:00, excluding motorcycle
3	28/06/2007	Kizinga river crossing	This study	15,200	14 hours from 6:00, excluding motorcycle

The traffic volume by type of vehicle at Bandari road as of Julu 2007 is summarized in **Table 4.1.2**.

Table 4.1.2 Traffic Volume by Type of Vehicle (14 hours) in 2007

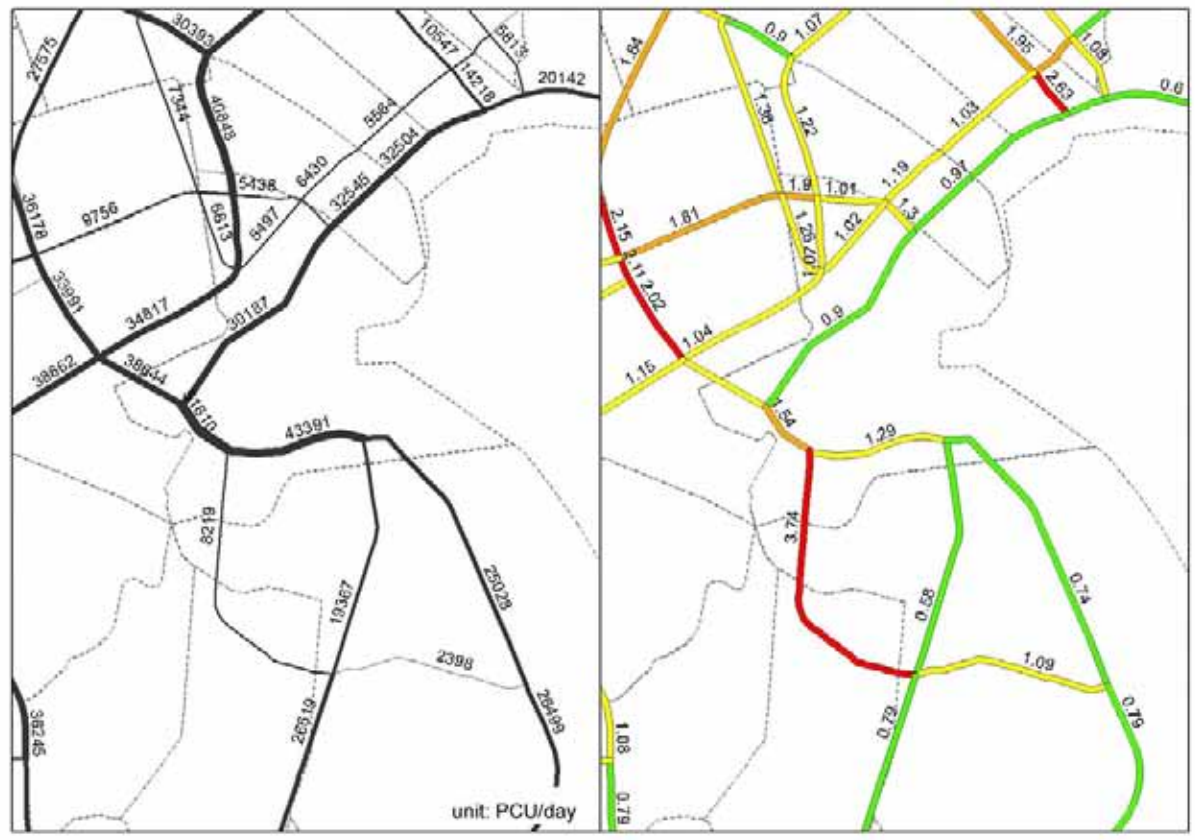
Type of Vehicle	Passenger Cars	Dala dala (Small)	Dala dala (Medium)	Other bus	Truck	3 axles, trailer	Motor Cycles	Others	Total
Volume	12,836	2,331	1,276	160	764	211	1,304	71	18,953

Source: Traffic count survey in 2007 conducted for Dar es Salaam Transport Policy and System Development Master Plan (JICA)

4.2 Future Traffic Demand

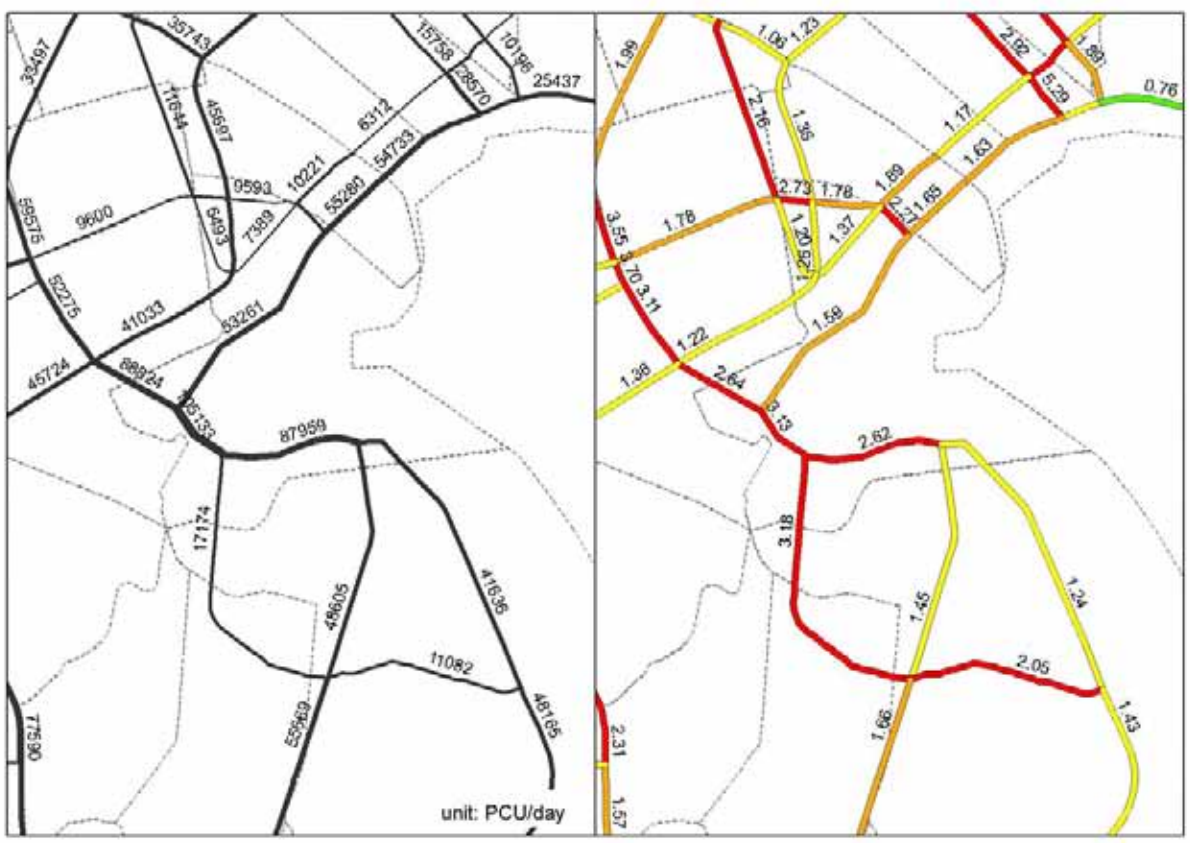
Figure 4.2.1 and **4.2.2** show the forecasted future traffic demand (by an incremental assignment procedure) and volume capacity ratios of roads in the Gerezani area in 2015 and 2030 respectively.

In 2015, traffic demand on Bandari Rd. will reach at 39 – 52 thousands pcu per day in both direction and volume capacity ratio (with case) will exceed 1.0. Actually, further capacity improvement options should be considered, for example 8-lane option; however, widening of more than 6 lanes (including 2 lanes for BRT) is technically very difficult in this area. The forecasted vehicular travel demand (mostly by passenger cars) assumes no strict traffic demand management (TDM) scheme in CBD and surrounding area, accordingly a significant number of trips is made by private modes of transport in the simulation. To achieve better transport environment it is very necessary to consider some sorts of TDM technique in CBD and the surrounding area. However, it should be noted that such advanced techniques are not taken into consideration in this preliminary feasibility study. As indicated in Chapter 2, priority consideration is given to future BRT operation in this area, then possible road capacity improvement was prepared.



Note: the figures exclude BRT traffic

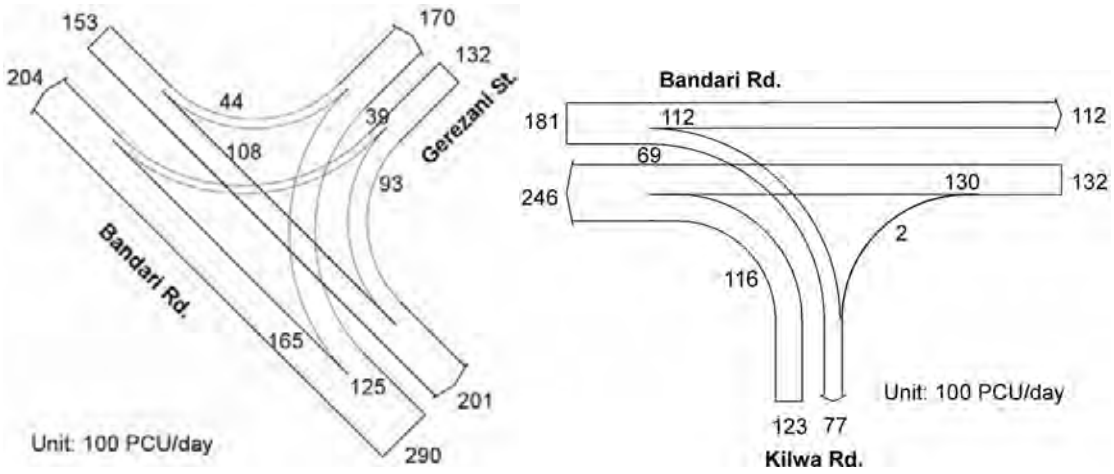
Figure 4.2.1 Daily Traffic Demand (left) and Volume Capacity Ratio (right) in 2015



Note: the figures exclude BRT traffic

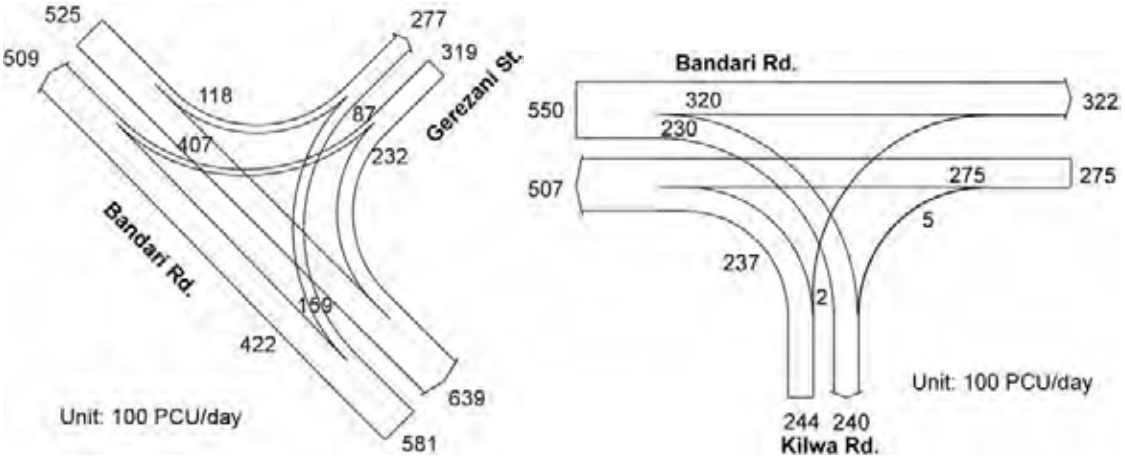
Figure 4.2.2 Daily Traffic Demand (left) and Volume Capacity Ratio (right) in 2030

Figure 4.2.3 and **4.2.4** show the forecasted future turning volume at existing Bandari roundabout and Bandari intersection in 2015 and 2030.



Note: the figures exclude BRT traffic

Figure 4.2.3 Directional Daily Traffic Demand at Bandari Roundabout (left) and Intersection (right) in 2015



Note: the figures exclude BRT traffic

Figure 4.2.4 Directional Daily Traffic Demand at Bandari Roundabout (left) and intersection (right) in 2030

A significant left- and right-turning traffic volume will be anticipated in future at the Bandari - Kilwa road intersection. At the same time through-traffic on Bandari road (to/from Dar es Salaam Port direction) of a similar volume will be expected; however, a very small traffic will be observed to make right-turn from Kilwa road to Bandari road (to the port direction). To manage such imbalanced traffic volume and pattern, it is recommended to develop a vehicle actuated (VA) traffic signal system at this junction.

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Chapter 5 Preliminary Design

5.1 Design Standards Consideration

Kilwa Road is designated as Type II Primary Arterial under the proposed road functional classification scheme by the Dar es Salaam Transport Policy and System Development Master Plan. However, there is no officially approved design standards available for such urban arterial roads.

The road design standards in Tanzania: the "Draft Road Manual" prepared by the former Ministry of Works is limited to those for national and regional trunk roads, but which is the only available standards in Tanzania. For the preliminary design purpose of this study, the "Draft Road Manual" is referred for designing main elements such as number of lanes, carriageway width, type etc. At the same time a special consideration to facilities for non-motorized modes such as footpath is made based on Japan's road design manual.

The principal design concepts applied for this preliminary study include:

- BRT line should be segregated from the mix traffic as much as possible;
- Follow the functional classification proposed in the Master Plan; and
- Utilization of existing facilities and right-of way as much as possible to reduce costs.

5.2 Design Principles

5.2.1 Design Speed and Geometric Design Standard

Bandari – Gerezani road segment is designated as Type II Primary Arterial, accordingly the design speed of this segment is 60km per hour as shown in **Table 5.2.1**. Associated other design elements are also shown in **Table 5.2.1** which were basically prepared based on the designs prepared for the current Kilwa road improvement. The project design life is assumed to be 15 years after completion of the Project.

Table 5.2.1 Design Parameters Proposed for the Project

Elements		Unit	Design Values
Design speed		km/h	60
Number of lanes		lane	4 for mix traffic
Width of land for road use		m	45
Lane width		m	9.5m/way including 2.5m shoulder
Median width for BRT		m	9.0 (2-lane)
Surface drainage gradient		%	2.5
Shoulder drainage gradient		%	2.5
Min. curve radius		m	135
Max. gradient		%	7
Super elevation (max. value)		%	6
Sight distance (min. value)		m	75
Embankment slope	Normal soil	-	1:1.5
Face of cut slope	Hard rock	-	1:0.5
	Soft rock	-	1:0.75
	Other than rock	-	1:1

5.2.2 Typical Cross Section

Bandari - Gerezani roads will be Type II primary arterial with four mixed traffic lanes and two BRT lanes, while Gerezani - Sokoine Drive will be a secondary road with two mixed traffic lanes and two BRT lanes. The Port crossing road (bridge) is categorized into one of the special roads: BRT exclusive bridge. Typical cross-sections for these roads are presented in **Figure 5.2.1**.

5.2.3 Bridge Design

For this preliminary feasibility study, Highway Bridge Specifications suggested by the Japan Road Association (JRA) were used.

5.2.4 Intersection Design

There are three major intersections in the Project area: Gerezani roundabout, Bandari roundabout and the intersection on Nyrere road. At present the Bandari intersection is a normal three-leg T-intersection, which will be changed to a new roundabout intersection by the Kilwa road project. For the operation of BRT, no roundabout is recommended for their priority and controlled operations, accordingly these two intersections need to be signalized intersections with priority consideration to BRT.

For crossing Nyerere road to reach the Kariakoo BRT terminal, a BRT flyover will be necessary because the traffic volume along Nyerere road has reached its capacity in the morning and evening peak hours already. At-grade BRT operation crossing Nyrere road should be avoided.

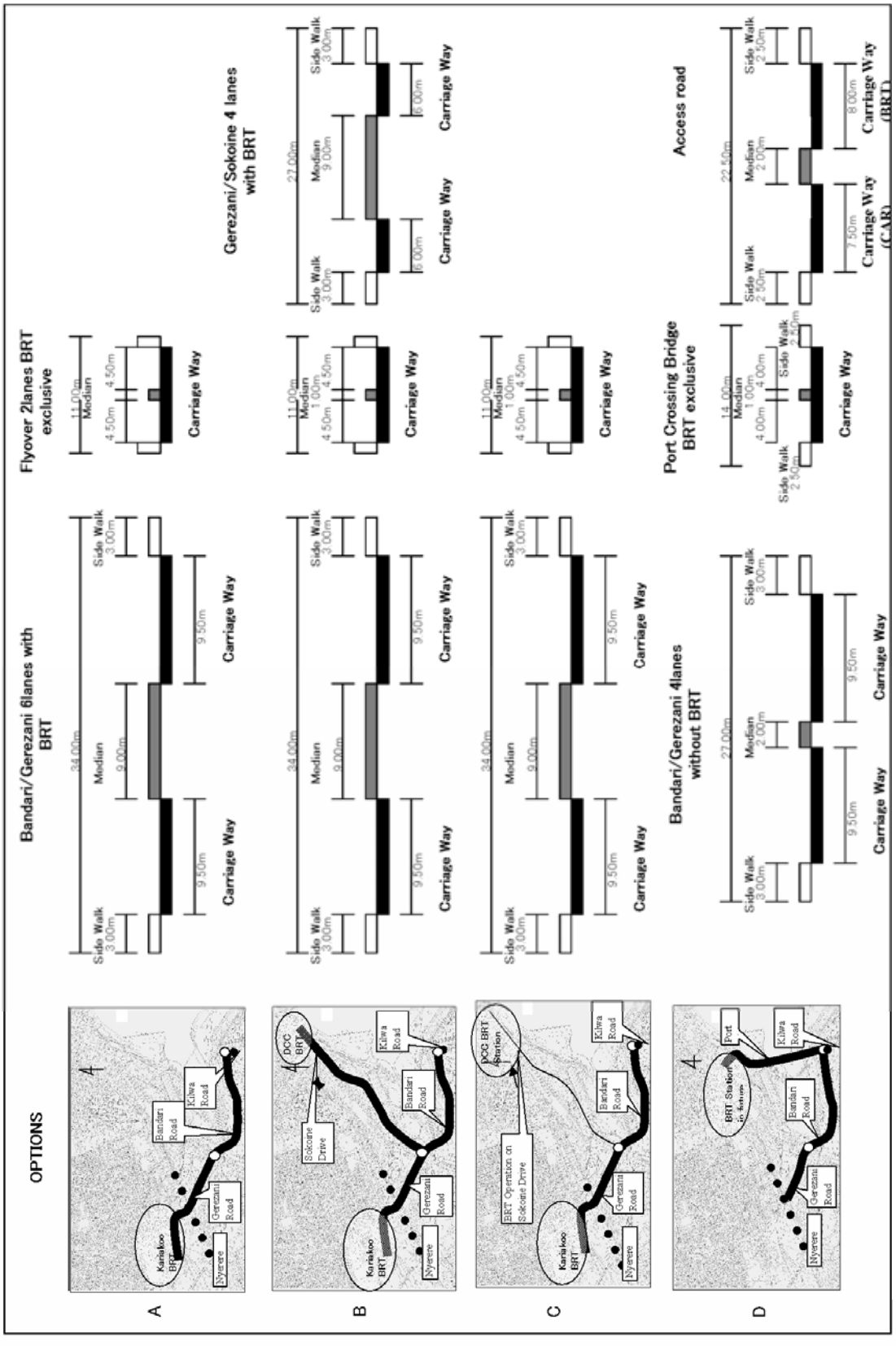

Figure 5.2.1 Typical Cross Sections

5.2.5 Pavement Design

The standard pavement structure in Tanzania is composed of asphalt concrete surface course, base course made of crushed stone for mechanical stabilization and sub-base course made of granular materials. The surface course and base of sidewalk is designed on the premise that no heavy vehicles pass there since the sidewalk is separated from roadway. Assuming annual increase of traffic volume is 4.0 %, the traffic load conditions for the planned road has been examined in order to set the standard axle load equivalent for each vehicle type (8.2 t axle load equivalent, ESA). The pavement design according to the Project shall ensure a design life of 15 years.

As per the Kilwa Road design, the pavement structure and specifications of roadway are as follows;

- Surface course: Asphalt concrete, 7 cm
- Base course: Crushed stone for mechanical stabilization, 20 cm
- Subbase course: Granular materials, 26 cm (locally available materials + cement stabilization)

As for the specifications of sidewalk are as bellows;

- Surface course: Double-layered asphalt with surface treatment (DBST)
- Base: Granular materials, 26 cm (locally available materials + cement stabilization)

5.2.6 Drainage Structure Design

The cross slope of the carriageway, shoulders and sidewalks should be 2~2.5% to drain surface water. Drainage structure design was made as follows:

(1) Culvert design

Minimum dimension of the pipe culvert might be 900 mm in consideration of maintenance. Transverse culverts should be designed with headwalls, wing walls and aprons. Minimum allowable velocity should be 0.8 m/sec. to prevent siltation and the maximum 3.0 m/sec. to avoid scouring.

(2) Side ditch design

Roadside ditch structures are depending on vertical slope condition of carriageway. These side ditches should be normally covered by grouted rip rap.

(3) Gerezani Creek Drainage

As described in previous section, flood often occurs in the Gerezani Creek. The existing box culvert for drain has choked with the increase of sediment, causing water flow stops frequently. Based on the discharge capacity of flood flow estimated at 20 m3/sec by the size of existing drainage channel, the culvert box should be reconstructed at the same point with section 3.5m x 5.0m.

5.3 Proposed Preliminary Designs

OPTION A and C

(1) Bandari Road

Bandari Road, beginning from Gerezani Roundabout, traverses over the railway by the 35 m long Gerezani Bridge and goes down to the B.P Deposit area. Following the existing road, the widening to 6 lanes (including 2 BRT lanes) in this section could be done in parallel with the existing road alignment. The total road to be widened is about 900m (see **Figure 5.3.1**).

(2) Gerezani Road

From Gerezani Roundabout, the road goes to Nyerere Road with a ROW width of about 20 m. Land acquisition and house compensation might be required for widening to 6 lanes (including 2 BRT lanes) along whole road length (about 400m) (see **Figure 5.3.1**).

(3) Gerezani Bridge

The Gerezani Bridge will pass over the existing railway lines. The height of the bridge could be determined in accordance of the vertical clearance height and its topographic condition. Bridge length could also be decided on the basis of horizontal clearance to the railway track with a skew condition. The proposed bridge design is given in **Figure 5.3.2**.

(4) Flyover Bridge crossing Nyerere

A flyover is necessary to overpass Nyerere Road, TRL and Msimbazi Street. The salient feature of proposed flyover is summarized in **Table 5.3.1**. And, plan and profile is given in **Figure 5.3.3**.

Table 5.3.1 Salient Feature of Flyover Passing Nyerere Road

Item	Description
Type of structure	Fly over passing Nyerere road
Total length	566m
Bridge portion	270m
Approach portion	132m+164m
Type of bridge	Post tension PC Girder
Girder height	2.50m
Width of fly over	11.00m
Carriageway	4.5m+4.5m=9m
Media portion	1m
Clearance	5.30m
Slope	4%
Span arrangement	8 spans(1@50m,5@30m, 2@35m)
Type of foundation	Concrete pile foundation

OPTION B

In addition to the works for Option A (or C), widening of Sokoine Drive is necessary for Option B (see **Figure 5.3.4**).

Keeping 9m median for BRT line, a single carriageway four-lane road will be developed using an open space on the slope between the existing Gerezani / Sokoine road and the harbor yard. Land acquisition and housing compensation might be necessary in this section. The total road length to be widened is about 1,450m.

OPTION D

For Option D a new elevated road link crossing the port area is necessary, which will provide a direct connection to the city center. This new bridge is designed as a two-lane BRT road with facilities for NMV such as side walks, cycle and carts. Length of bridge is about 560m including approach sections. Total length of this port crossing scheme is about 900 m (see **Figure 5.3.5**).

Table 5.3.2 Salient Feature of Each Option

		Option A	Option B	Option C	Option D
Circulation of BRT from Bandari Intersection		To Kariakoo BRT Bus Terminal via Bandari and Gerezani Road	To Kariakoo BRT Bus Terminal via Bandari and Gerezani Road and to DCC BRT Station via widened Gerezani/Sokoine Road	To Kariakoo BRT Bus Terminal via Bandari and Gerezani Road and to DCC BRT Station via existing Gerezani/ Sokoine Road with access control	To BRT Station in future and DCC BRT station via new bridge passing the port and port access road
Type of Road to be Developed		Widening of existing road and flyover	Widening of existing road and flyover	Same as option A	New bridge construction , widening of existing port access road and Bandari/Gerezani road
Classification of Road after Development		Type II Primary Arterial Road (with BRT)	Bandari/Gerezani Road: Type II Primary Arterial Road (with BRT), Gerezani/Sokoine Road: Secondary with BRT		Special classification
Road Length to be widened		1,300m (up to the end of BRT line :1,670m)	Bandari/Gerezani: 1,300m(up to the end of BRT line:1,670m) + Gerezani/Sokoine1,450m		Bandari/Gerezani:1,300m, port access road 368m
Typical Cross Section		Total width: 34m (9m median for 2 BRT lines, 2 carriage way @ 9.5m, side walk @3m)	Total width: 34m (9m median for 2 BRT lines, 2 carriage way @ 9.5m, side walk @3m) ; Sokoine 1carriage way @6m		Bridge width : 9m for BRT exclusive line and 2 wide walk @2.5m, Road: 27m (2m median, 2 carriage way @ 9.5m, side walk @3m)
Pavement Structure		Surface: AC7cm, base course:20cm crushed stone, subbase course: 26cm cement stabilization	Surface: AC7cm, base course: 20cm crushed stone, subbase course: 26cm cement stabilization		Surface: AC7cm, Base course:20cm crushed stone, subbase course: 26cm cement stabilization
Major Required Structure	Flyover	Bridge: PC box girder 270m length, 296m transition, 11m width for BRT exclusive 2 lines, 8 Spans	Same as option A		——
	Bridge	35m length, 34m width of T type PC Girder, single span, pile foundation			(Port crossing bridge) PC box girder 392m length、6 spans, 14m width (Gerezani bridge) 35m length, 27m width of T type PC Girder
	Box Culvert	3.5m*5.0m,52m single sell			3.5m*5.0m,41m single sell
Remarks		——	——	Existing Gerezani/Sokoine Road directed by one way toward city center : one line for BRT and another for cars	Mix traffic turned from/to Kilwa road will diverted to widened 4 lanes Bandari Gerezani Road connected from/to Nyerere road

Source: JICA Study Team

Figure 5.3.1 Bandari – Gerezani Road (6-lane)

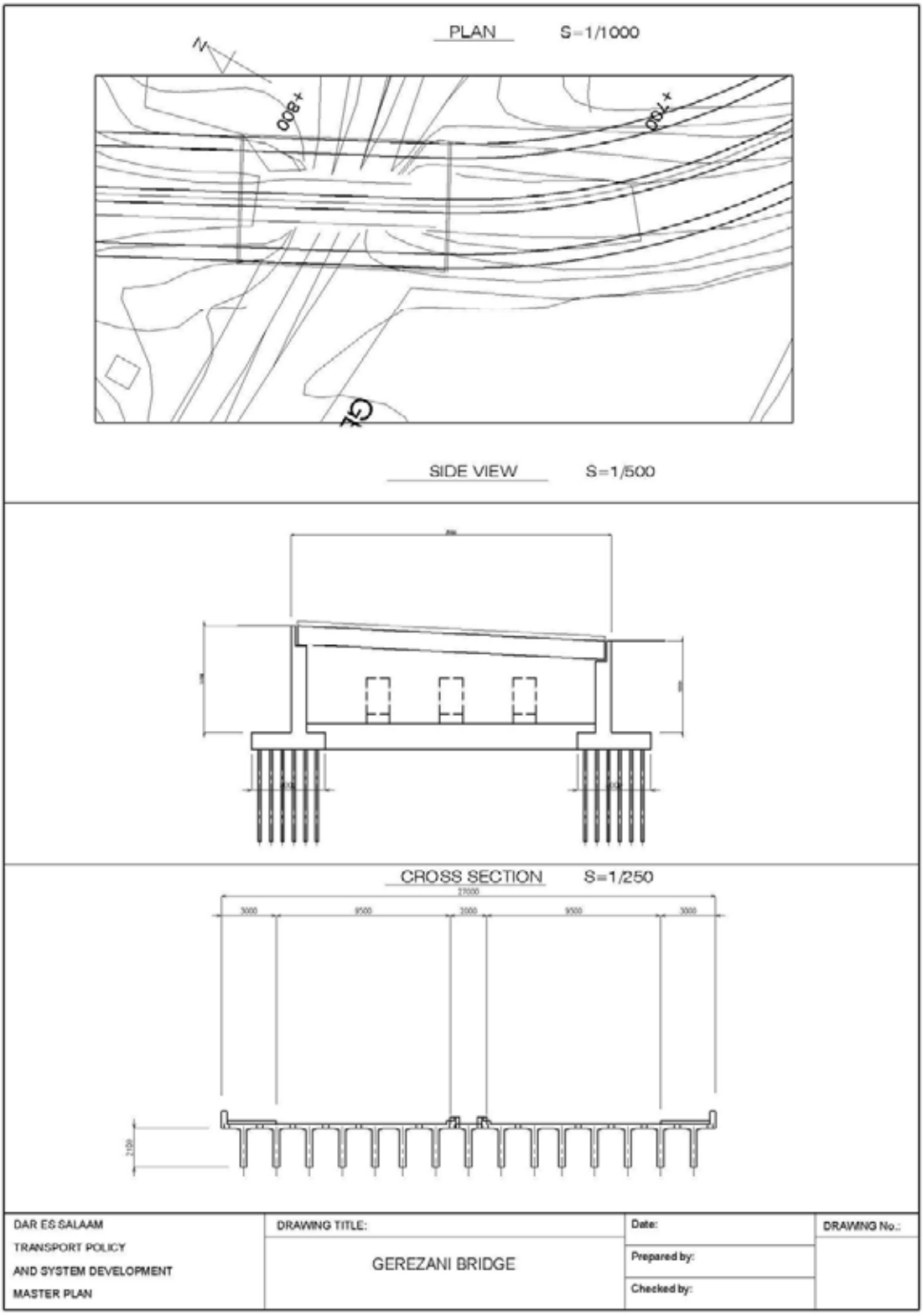

Figure 5.3.2 Gerezani Bridge Improvement

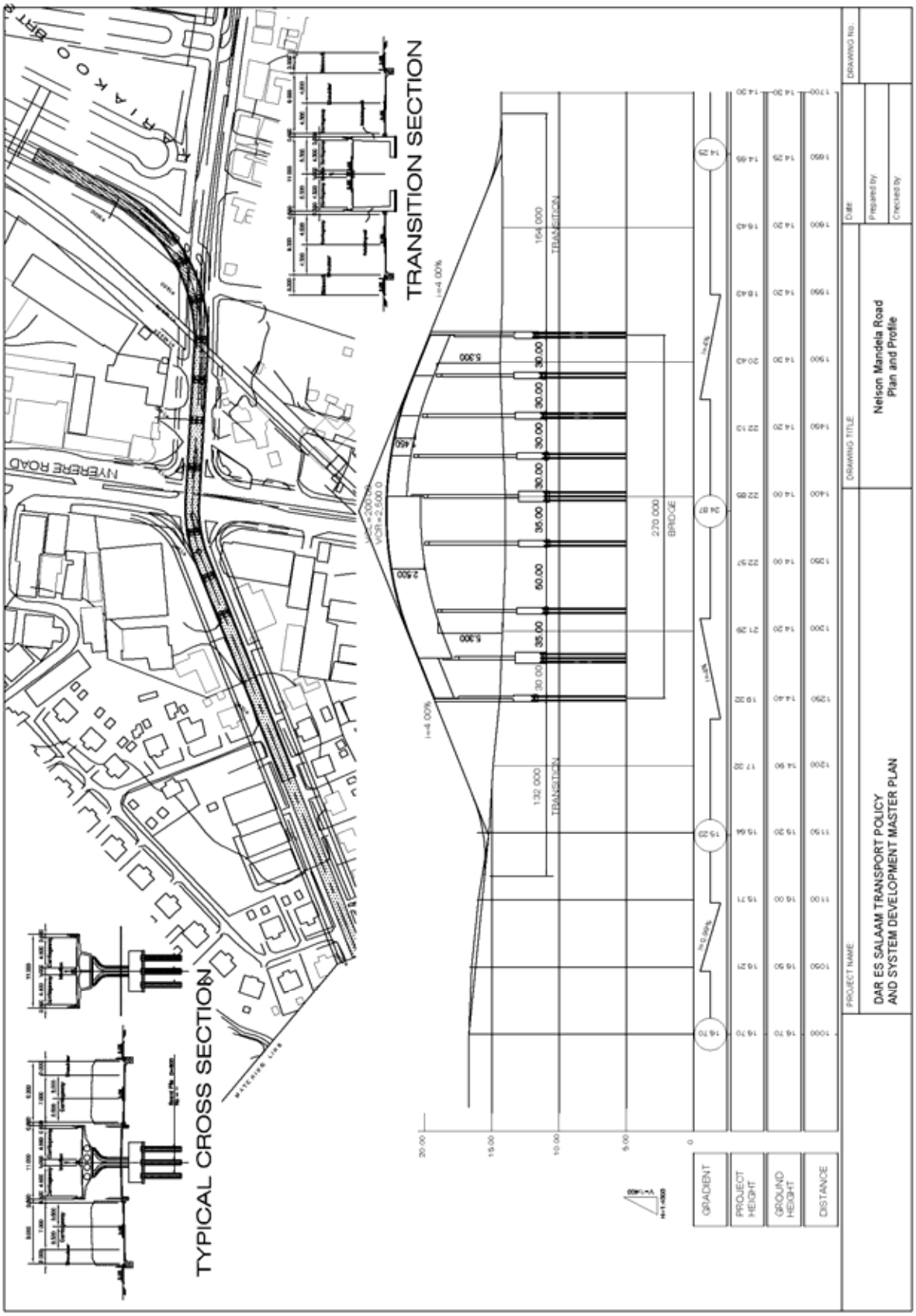

Figure 5.3.3 Gerezani Flyover for BRT (2-lane)

Figure 5.3.4 Sokoine Drive Widening

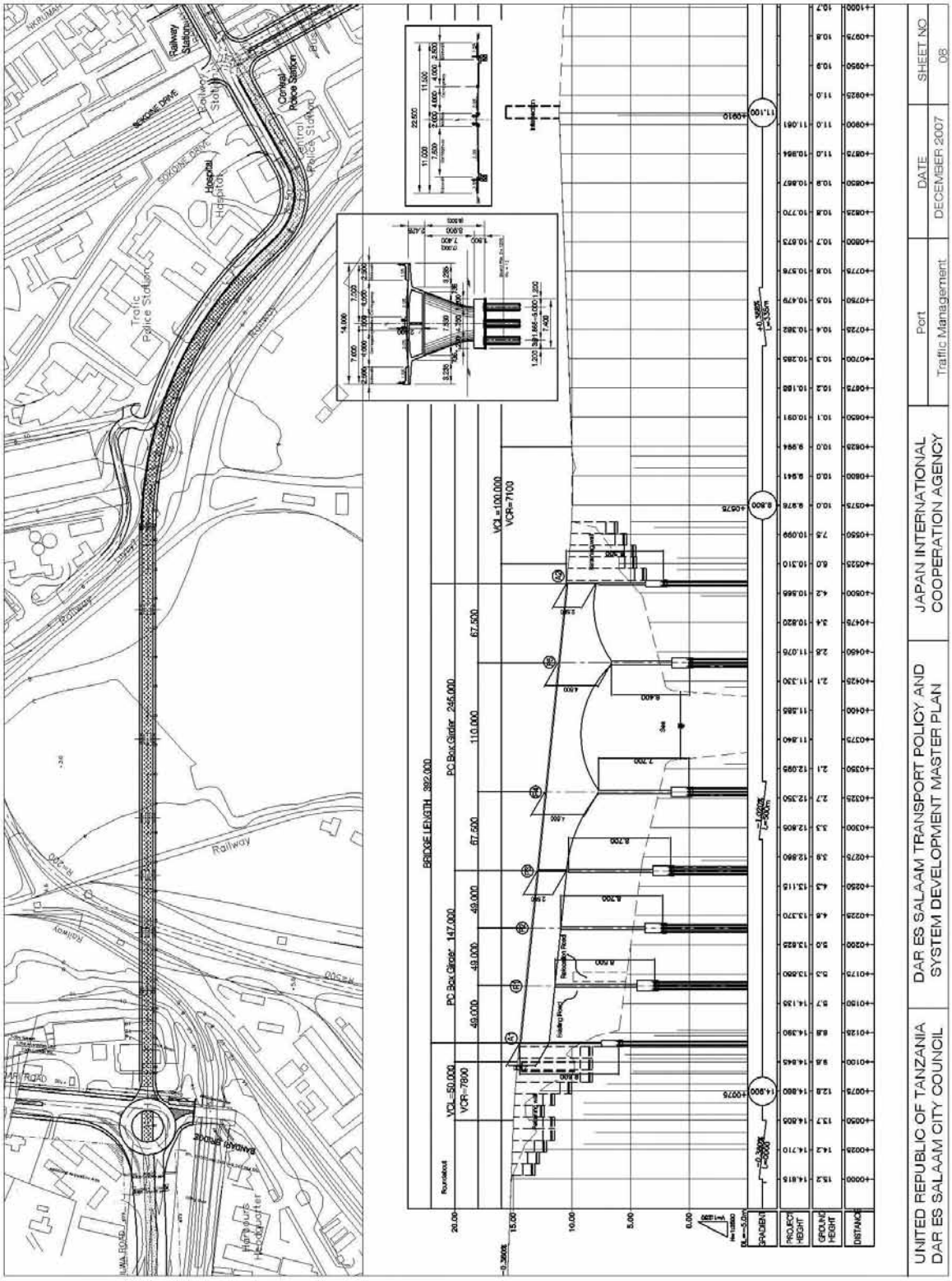

Figure 5.3.5 BRT Habour Crossing Bridge

Chapter 6 Construction Plan

6.1 General

This chapter describes a preliminary construction plan that is made based on the preliminary design and several site conditions. The construction plan is used as a guideline not only for the actual implementation of the construction works but also for the preliminary project cost estimate. For these purposes, (i) basic conditions such as workable day, construction materials, and temporary facilities, (ii) outline of the practical construction method, and (iii) construction period are examined in this chapter.

6.2 Basic Conditions

6.2.1 Workable day

The monthly rainfall of the Dar es Salaam City ranges from 26.1 mm to 263.3 mm (93.7 mm on average) and the annual rainfall is 1,124 mm, according to the rainfall data recorded in Statistical Abstract 2002, Nation Bureau of Statistics (2003) as mentioned in the previous chapter. From this record, intensive rainfall is observed in the period between March and May with the total rainfall during this period accounting for about 55% of the annual rainfall.

Workable days for major construction works, comprising excavation works, embankment works, concrete works and pavement works are based on the daily rainfall. The suspended day due to rainfall is assumed to be the day having the rainfall of more than 10 mm/day in general. Thus, the workable day during the construction works in the Dar es Salaam City will not be much affected by rainfall except the rainy season between March and May.

6.2.2 Construction Materials

(1) Natural construction materials

Construction materials used for the concrete structures, asphalt surface course, base and sub-base courses, and embankment can be obtained from the following materials sources:

Table 6.2.1 Natural Construction Material Sources

Materials	Name of Sources	Distance from the Bandari Intersection of Dar es Salaam (km)
Course Aggregate	Lugaba	150
Fine Aggregate	Mbagala	16
Coral Aggregate	Mjimwema	35
Laterite Soil for Embankment	Tuangoma	18

Source: JICA Study Team

At present the above materials are being utilized in the Kilwa road widening project.

(2) Asphalt materials

Almost all the asphalt materials are imported from Saudi Arabia through domestic agents. Several suppliers are presently in business in Dar es Salaam City, therefore, such imported asphalt materials can be obtained from the domestic market.

(3) Cement

Cement is produced domestically and distributed by four cement industrial companies in Tanzania. The TANGA Cement Industries Limited, located about 15 km north-west from the Kilwa road, has a production of 2,200 ton/day at full capacity. Meanwhile, the import of cement from abroad is presently limited by the Tanzanian government.

(4) Reinforcement bar

Although the reinforcement bar is being produced by six factories in Tanzania, such domestic products still have a problem on the quality control. Meanwhile, the reinforcement bar in good quality, imported from South Africa, Egypt, and Ukraine, is available in the domestic market. Selling price of the products imported is the same as the domestic products.

(5) Wood materials

Wood materials such as plywood and other timers can be obtained from the domestic market.

6.2.3 Temporary facilities

Temporary facilities for the construction works consist mainly of temporary buildings (i.e., contractor's office, camp, laboratory, and workshop), concrete batching plant, asphalt plant, and spoil bank. These temporary facilities can be located around the project site. The exiting temporary yard, which is being utilized by the Kilwa road project, is proposed as a candidate for the temporary yard.

6.3 Construction Method

Among the existing four options (i.e., Option A, Option B, Option C, and Option D), the design of Option A is the same as Option C, as described in the previous chapter of this report. Each construction method is described hereinafter.

6.3.1 Option A, C

The construction work is composed of; (i) widening of the Bandari road and Gerezani road, (ii) replacement of the Gerezani bridge, (iii) construction of a box culvert, and (iv) construction of a flyover bridge.

The workflow of the above four works is considered that each of the four works can be conducted in parallel. Meanwhile, the working fleet of the construction work can be divided into two groups, i.e., the above (i), (ii), and (iii) in one group for road construction, and the remaining (iv) in another group for bridge construction. Details of the construction workflow for each group are as follows:

1) Road construction works for widening of the existing roads (total length :1,300 m, 6 lanes)
   - Earthwork, comprising excavation and embankment
   - Pavement work, comprising sub-base course, base course, and surface course
   - Drainage work, comprising cross drain, culvert drain, and ditch drain
   - Bridge construction work of the Gerezani bridge, comprising foundation piling, abutments, and superstructure (T type PC girder)
2) Bridge construction works for flyover (bridge length :260 m, approach length :265 m, 2 lanes)
   - Foundation piling works by cast-in-situ bored concrete pile with 0.8 m in diameter
   - Construction works of abutments and piers including the retaining wall of approach portion
   - Embankment works within approach portion
   - Construction works of post-tensioned PC hollow slab by frame scaffolding method
   - Pavement works of road in approach portion and bridge portion

Among the above work items, the post-tensioned PC hollow slab needs to be constructed by mobilizing a skilled foreign worker/ supervisor due to the first construction works of post-tensioned PC hollow slab in Tanzania.

6.3.2 Option B

The construction work is composed of; (i) widening of the Bandari road, the Gerezani road, and the Sokoine road, (ii) replacement of the Gerezani bridge, (iii) construction of a box culvert, and (iv) construction of a flyover bridge.

The Option B component is the above Option A, C plus the widening of the Sokoine road with 1,450 m in length and 4 lanes. Therefore, the construction workflow of Option B is the same manner as the above Option A, C.

6.3.3 Option D

The construction work is composed of; (i) construction of a port crossing bridge, (ii) widening of the Bandari road and Gerezani road, (iii) replacement of the Gerezani bridge, and (iv) construction of a box culvert.

The workflow of the above four works is considered that each of the four works can be conducted in parallel. Meanwhile, the working fleet of the construction work can be divided into two groups, i.e., the above (i) in one group for bridge construction, and the remaining (i), (ii), and (iv) in another group for road construction. Details of the construction workflow for each group are as follows:

1) Bridge construction works for port crossing bridge (bridge length :392 m, approach length :140 m, 2 lanes)
    - Foundation piling works by cast-in-situ bored concrete pile with 1.2 m in diameter
    - Construction works of abutments and piers including the retaining wall of approach portion
    - Embankment works within approach portion
    - Construction works of post-tensioned PC box girder by frame scaffolding method
    - Pavement works of road in approach portion and bridge portion
2) Road construction works for widening of the existing roads (total length :1,668 m in, 4 lanes)
    - Earthwork, comprising excavation and embankment
    - Pavement work, comprising sub-base course, base course, and surface course
    - Drainage work, comprising cross drain, culvert drain, and ditch drain
    - Bridge construction work of the Gerezani bridge, comprising foundation piling, abutments, and superstructure (T type PC girder)

6.4 Construction Period

The construction period is estimated taking into account the practical workflow of all the construction works. The critical path of the construction schedule is placed on the preparatory works and the main construction works in principal.

Each construction period is estimated hereinafter

6.4.1 Option A, C

The critical path of the construction schedule is placed on the preparatory works and the widening of the Bandari/ Geredani roads including the Gerezani bridge, since the flyover can be constructed in parallel with the widening of the Bandari/ Gerezani roads.

The preparatory works consist of (i) construction of the temporary buildings (i.e., contractor's office, camp, laboratory, and workshop) including water supply system, electric power supply system and telecommunication system, (ii) mobilization of the construction equipment, (iii) assembly/ installation of the concrete batching plant and asphalt plant, and (iv) order/ procurement of the imported materials. The required period for the preparatory works is estimated at three months. The detailed construction works are as mentioned in the preceding section 6.3.1. The required period for the widening of the Bandari/ Gerezani roads including the Gerezani brige is estimated at 21 months, in consideration of the detailed construction works and the actual construction schedules of similar projects.

As a result, the total construction period is estimated at 24 months (two years).

6.4.2 Option B

The critical path of the construction schedule is placed on the preparatory works and the widening of the Bandari/ Geredani/ Sokoine roads including the Gerezani bridge, since the flyover can be constructed in parallel with the widening of the Bandari/ Gerezani/ Sokoine roads.

The required period for the preparatory works is estimated at three months that is the same as the Option A, C. The detailed construction works are as mentioned in the preceding section 6.3.2. The required period for the widening of the Bandari/ Gerezani/ Sokoine roads including the Gerezani brige is estimated at 27 months, in consideration of the detailed construction works and the actual construction schedules of similar projects.

As a result, the total construction period is estimated at 30 months (two and a half years).

6.4.3 Option D

The critical path of the construction schedule is placed on the preparatory works and the port crossing bridge, since the widening of the Bandari/ Gerezani/ Sokoine roads can be constructed in parallel with the port crossing bridge.

The required period for the preparatory works is estimated at three months that is the same as the Option A, C and Option B. The detailed construction works are as mentioned in the preceding section 6.3.3. The required period for the port crossing bridge is estimated at 33 months, in consideration of the detailed construction works and the actual construction schedules of similar projects.

As a result, the total construction period is estimated at 36 months (three years).

Chapter 7 Cost Estimates

7.1 General

This chapter described the project cost estimate that is made based on the preliminary design and the construction plan. The project cost estimate is made with the unit cost estimate method in principal. The project cost consists of (i) construction cost, (ii) engineering services cost, (iii) contingency, and (iv) government administration cost including cost for house compensation and replacement of public utilities.

7.1.1 Basic Conditions and Assumptions

The basic conditions and assumptions of the cost estimate are as follows:

(1) The cost estimate is made in Tanzanian Shilling (Tshs) for both foreign and local currency components.

(2) The local currency component covers the costs of local labor and locally available materials such as aggregate, asphalt, cement, reinforcing bars, and fuel. The costs of imported materials, imported facilities and depreciation of construction equipment are allocated in the foreign currency component.

(3) The exchange rates as of the 2nd of October 2007 used in the cost estimate are as follows:
US$ 1.0 = Tshs 1,271.26 = Yen 116.74

(4) It has been assumed that the construction work will to be undertaken by competent contractors selected through international competitive bidding (ICB).

(5) Each of the unit costs of major work items is estimated based on the cost data obtained from the Kilwa road project and other similar projects.

(6) No tax has been included in the cost estimate.

7.2 Cost Estimate Method

7.2.1 Preparatory Works

The cost for preparatory works consist mainly of (i) construction cost for the temporary buildings (i.e., contractor's office, camp, laboratory, and workshop) including water supply system, electric power system and telecommunication system, (ii) procurement cost for the furniture required for the temporary buildings, laboratory equipment, survey equipment, and (iii) transportation cost including packing for the construction equipment to be imported.

The cost for the temporary works is estimated at 7% of the total cost of the civil works.

7.2.2 Civil Works

The construction cost for each civil work is estimated by multiplying work quantity and unit costs in principal. The cost components of the breakdown of unit price comprise labor wage, material cost, equipment cost, and contractor's indirect cost. Each cost component is explained as below.

(1) Labor wage

Labor wage is based on the basic daily wages in 8-hour per shift for each kind of labor. Each labor wage is shown below:

Table 7.3.1 Labor Wage

(Unit :Tshs)

Labor	Unit	Wage
Foreman	day	18,313
Skilled labor	day	9,572
Common labor	day	7,855
Unskilled labor	day	6,284
Operator for heavy equipment	day	17,326
Driver for light vehicle	day	16,496
Carpenter	day	14,588
Welder	day	20,199
Mechanic	day	20,951
Electrician	day	22,443

Remarks: Labor wages were based on the daily wages including social insurance, overtime, layoff allowance and retirement allowance.

(2) Material cost

As described in the preceding Section 6.2.2 Construction Materials, almost all the materials will be obtained from the domestic market. Each material cost is shown below:

Table 7.3.2 Material Cost

(Unit :Tshs)

Material	Unit	Unit Cost
Gasoline	liter	1,500
Diesel	liter	1,450
Portland cement	ton	213,013
Reinforcement bar	ton	1,070,531
Fine aggregate	m^3	22,443
Coarse aggregate	m^3	47,130
Cut back asphalt	ton	570,613
Straight asphalt	ton	532,572
Emulsified asphalt	liter	3,804
Plywood (thickness 4-22mm)	m^2	51,507
Timber	m^3	618,080
Wooden pile (φ8cm)	m	17,169
Wood	m^3	515,067

(3) Equipment cost

The equipment cost consists of depreciation cost, repair and maintenance cost, and annual administration cost. Almost all the equipment will be procured from abroad except for some locally available equipment. Therefore the equipment costs on hourly or daily basis, which are calculated based on the authorized guideline prevailing in Japan, are applied in the cost estimate.

(4) Contractor's indirect cost

Overhead expenses and profits have been allocated to the unit costs of each work item. These expenses are estimated at 19% of the direct cost comprising labor wage, material cost and equipment cost.

(5) Unit cost of major work items

The unit costs of major civil works are estimated based on the cost data obtained from the Kilawa road project and other similar projects. Each unit cost is shown below:

Table 7.3.3 Unit Cost of Major Work Items

Unit :Tshs

Work Items	Unit	Foreign Currency Portion	Local Currency Portion	Total
1. Earthwork				
Excavation,common	m3	8,686	2,171	10,857
Embankment, common	m3	13,018	3,254	16,272
2. Pavement work				
Carriageway	m2	9,323	52,829	62,152
(subbase course t=26cm, base course t=20cm, asphalt surface t=7cm)				
Shoulder	m2	3,829	21,698	25,527
(shoulder aggregate course t=26cm, DBST))				
Side walk, DBST	m2	2,054	11,637	13,691
(subbase course t=10cm, DBST)				
Median, sodding	m2	0	1,882	1,882
3. Concrete work				
Retaining wall, concrete structure	m3	77,153	308,611	385,764
4. Drainage work				
Cross drain, RC pipe, dia.= 900 mm	m	62,093	558,841	620,934
Culvert drain, RC box, 3.5 x 5.0 m	m	637,333	2,549,334	3,186,667
Ditch drain, V-shaped	m	7,595	68,351	75,945
5. Slope protection work				
Gabion mattress, h = 2.5 m	m	39,365	354,281	393,645
Retaining wall, concrete structure	m3	77,153	308,611	385,764
6. Bridge construction work				
Extradosed prestressing type	m2	4,905,030	2,102,156	7,007,185
PC box girder type	m2	2,291,447	982,049	3,273,495
PC T girder type/ hollow slab type	m2	1,570,642	673,132	2,243,774
7. Road facilities				
Bus stop, L = 500 m	no.	576,674	865,011	1,441,685
Road lighting	no.	2,242,341	1,207,414	3,449,755
Traffic signal	no.	7,012,398	779,155	7,791,553
Road information signs	no.	61,356	15,339	76,695
Lane marking, contineous line, 15 cm in width	m	66	1,256	1,322
Guard rail	m	0	426,686	426,686
Kerb stone	m	1,079	20,494	21,573

7.2.3 Engineering Services Cost

The cost for engineering service for detailed design and supervision is estimated at 7% of the construction cost.

7.2.4 Contingency

The contingency required for the project budgeting consists of (i) physical contingency to cover unforeseen changes of physical conditions and (ii) price contingency to compensate for future price escalation. The cost for the contingency is estimated at 10% of the construction cost.

7.2.5 Government Administration Cost

The government administration cost consists of (i) the cost for house compensation and replacement of public utilities and (ii) administration cost of the project owner. Details of the cost for house compensation and replacement of public utilities is described in the Chapter 2 Environmental Study of the Technical Report Vol. 9. The administration cost of the project owner is estimated at 1% of the construction cost.

7.3 Total Project Cost

7.3.1 Option A, C

Total project cost is estimated at Tshs 20,944 million comprising foreign currency portion of Tshs 9,182 million and local currency portion of Tshs 11,762 million and is summarized below:

Table 7.4.1 Summary of Project Cost (Option A, C)

Unit :Tshs

Work Items	Unit	Quantity	Unit Cost		Amount		
			F.C.	L.C.	F.C.	L.C.	Total
A. Construction Cost							
1) Earthwork							
Excavation	m3	15,142	8,686	2,171	131,517,356	32,879,339	164,396,695
Embankment	m3	29,871	13,018	3,254	388,848,730	97,212,183	486,060,913
2) Pavement work							
Carriageway	m2	24,700	9,323	52,829	230,273,160	1,304,881,240	1,535,154,400
Side walk	m2	7,800	2,054	11,637	16,018,470	90,771,330	106,789,800
Median	m2	11,700	0	1,882	0	22,019,400	22,019,400
3) Drainange work							
Cross drain	m	240	62,093	558,841	14,902,416	134,121,744	149,024,160
Culvert drain	m	56	637,333	2,549,334	35,690,671	142,762,682	178,453,353
Ditch drain	m	2,600	7,595	68,351	19,745,700	177,711,300	197,457,000
4) Bridge structure							
Gerezani bridge, T girder type	m2	1,190	1,570,642	673,132	1,869,063,980	801,027,080	2,670,091,060
5) Flyover							
PC hollow slab type	m2	1,650	1,570,642	673,132	2,591,559,300	1,110,667,800	3,702,227,100
PC Box Girder	m2	880	2,291,447	982,049	2,016,473,360	864,203,120	2,880,676,480
Approach portion							
Embankment	m3	6,622	13,018	3,254	86,202,548	21,550,637	107,753,185
Retaining wall	m3	1,332	77,153	308,611	102,767,530	411,070,119	513,837,649
Road							
Guardrail	m	592	0	426,686	0	252,598,112	252,598,112
Carriageway	m2	2,664	9,323	52,829	24,835,940	140,736,989	165,572,929
Median	m2	296	0	1,882	0	557,072	557,072
6) Slope protection work							
Gabion mattress, h = 2.5m	m	165	39,365	354,281	6,495,143	58,456,283	64,951,426
7) Road facilities							
Bus stop	no.	3	576,674	865,011	1,730,022	2,595,033	4,325,055
Road lighting	no.	26	2,242,341	1,207,414	58,300,860	31,392,771	89,693,631
Traffic signal	no.	6	7,012,398	779,155	42,074,387	4,674,932	46,749,319
Lane marking	m	3,900	66	1,256	257,790	4,898,010	5,155,800
Guard rail	m	390	0	426,686	0	166,407,540	166,407,540
Sub-total of 1) to 7)					7,636,757,363	5,873,194,716	13,509,952,079
8) Preparatory works (7% of Sub-total)					534,573,015	411,123,630	945,696,646
Total Construction Cost					8,171,330,378	6,284,318,346	14,455,648,725
B. Engineering Services Cost							
Detailed design & Supervision (7% of A)					571,993,126	439,902,284	1,011,895,411
C. Contingency							
Price escalation & Physical change (10% of A)					817,133,038	628,431,835	1,445,564,872
D. Government Administration Cost							
Cost for house compensation and replacement of public utilities					0	4,530,303,000	4,530,303,000
Administration cost (1% of A)					0	144,556,487	144,556,487
Grand Total (A + B + C + D)					9,560,456,543	12,027,511,952	21,587,968,495

7.3.2 Option B

Total project cost is estimated at Tshs 26,567 million comprising foreign currency portion of Tshs 9,857 million and local currency portion of Tshs 16,710 million and is summarized below:

Table 7.4.2 Summary of Project Cost (Option B)

Unit :Tshs

Work Items	Unit	Quantity	Unit Cost		Amount		
			F.C.	L.C.	F.C.	L.C.	Total
A. Construction Cost							
1) Earthwork							
Excavation	m3	20,742	8,686	2,171	180,156,716	45,039,179	225,195,895
Embankment	m3	36,713	13,018	3,254	477,915,149	119,478,788	597,393,937
2) Pavement work							
Carriageway	m2	52,250	9,323	52,829	487,116,300	2,760,325,700	3,247,442,000
Side walk	m2	16,500	2,054	11,637	33,885,225	192,016,275	225,901,500
Median	m2	24,750	0	1,882	0	46,579,500	46,579,500
3) Drainange work							
Cross drain	m	396	62,093	558,841	24,588,987	221,300,878	245,889,865
Culvert drain	m	56	637,333	2,549,334	35,690,671	142,762,682	178,453,353
Ditch drain	m	5,500	7,595	68,351	41,769,750	375,927,750	417,697,500
4) Bridge structure							
Gerezani bridge, T girder type	m2	1,190	1,570,642	673,132	1,869,063,980	801,027,080	2,670,091,060
5) Flyover, PC hollow slab type							
Bridge portion	m2	2,750	1,570,642	673,132	4,319,265,500	1,851,113,000	6,170,378,500
Approach portion							
Embankment	m3	6,625	13,018	3,254	86,241,600	21,560,400	107,802,000
Retaining wall	m3	1,193	77,153	308,611	92,043,291	368,173,162	460,216,453
Road							
Guardrail	m	530	0	426,686	0	226,143,580	226,143,580
Carriageway	m2	2,385	9,323	52,829	22,234,878	125,997,642	148,232,520
Median	m2	265	0	1,882	0	498,730	498,730
6) Slope protection work							
Gabion mattress, h = 2.5m	m	165	39,365	354,281	6,495,143	58,456,283	64,951,426
7) Road facilities							
Bus stop	no.	6	576,674	865,011	3,460,044	5,190,066	8,650,110
Road lighting	no.	55	2,242,341	1,207,414	123,328,742	66,407,784	189,736,526
Traffic signal	no.	10	7,012,398	779,155	70,123,977	7,791,553	77,915,530
Lane marking	m	8,150	66	1,256	538,715	10,235,585	10,774,300
Guard rail	m	540	0	426,686	0	230,410,440	230,410,440
Sub-total of 1) to 7)					7,873,918,668	7,676,436,057	15,550,354,725
8) Preparatory works (7% of Sub-total)					551,174,307	537,350,524	1,088,524,831
Total Construction Cost					8,425,092,975	8,213,786,581	16,638,879,556
B. Engineering Services Cost							
Detailed design & Supervision (7% of A)					589,756,508	574,965,061	1,164,721,569
C. Contingency							
Price escalation & Physical change (10% of A)					842,509,297	821,378,658	1,663,887,956
D. Government Administration Cost							
Cost for house compensation and replacement of public utilities					0	6,933,540,000	6,933,540,000
Administration cost (1% of A)					0	166,388,796	166,388,796
Grand Total (A + B + C + D)					9,857,358,780	16,710,059,095	26,567,417,876

7.3.3 Option D

Total project cost is estimated at Tshs 33,122 million comprising foreign currency portion of Tshs 19,026 million and local currency portion of Tshs 14,096 million and is summarized below:

Table 7.4.3 Summary of Project Cost (Option D)

Unit :Tshs

Work Items	Unit	Quantity	Unit Cost		Amount		
			F.C.	L.C.	F.C.	L.C.	Total
A. Construction Cost							
A.1 Port crossing bridge including road widening							
1) Bridge portion, PC box girder type	m2	5,488	2,291,447	982,049	12,575,461,136	5,389,484,912	17,964,946,048
2) Approach portion							
Embankment	m3	7,056	13,018	3,254	91,852,186	22,963,047	114,815,233
Retaining wall	m3	784	77,153	308,611	60,487,796	241,951,181	302,438,977
3) Pavement work							
Carriageway	m2	3,128	9,323	52,829	29,161,719	165,249,738	194,411,457
Side walk	m2	1,104	2,054	11,637	2,267,230	12,847,635	15,114,865
Median	m2	2,944	0	1,882	0	5,540,608	5,540,608
4) Drainange work							
Cross drain	m	26	62,093	558,841	1,614,429	14,529,856	16,144,285
Ditch drain	m	736	7,595	68,351	5,589,552	50,305,968	55,895,520
5) Slope protection work							
Gabion mattress, h = 2.5m	m	255	39,365	354,281	10,037,948	90,341,528	100,379,476
6) Road facilities							
Bus stop	no.	1	576,674	865,011	576,674	865,011	1,441,685
Road lighting	no.	18	2,242,341	1,207,414	40,362,134	21,733,457	62,095,591
Traffic signal	no.	8	7,012,398	779,155	56,099,182	6,233,243	62,332,425
Lane marking	m	1,104	66	1,256	72,975	1,386,514	1,459,489
Guard rail	m	255	0	426,686	0	108,804,930	108,804,930
A.1 Sub-total of 1) to 6)					12,873,582,961	6,132,237,628	19,005,820,589
A.2 Bandari/Gerezani Road widening							
1) Earthwork							
Excavation	m3	9,076	8,686	2,171	78,830,506	19,707,627	98,538,133
Embankment	m3	21,511	13,018	3,254	280,021,594	70,005,399	350,026,993
2) Pavement work							
Carriageway	m2	24,700	9,323	52,829	230,273,160	1,304,881,240	1,535,154,400
Side walk	m2	7,800	2,054	11,637	16,018,470	90,771,330	106,789,800
Median	m2	2,600	0	1,882	0	4,893,200	4,893,200
3) Drainange work							
Cross drain	m	106	62,093	558,841	6,581,901	59,237,104	65,819,005
Culvert drain	m	43	637,333	2,549,334	27,405,337	109,621,345	137,026,682
Ditch drain	m	2,600	7,595	68,351	19,745,700	177,711,300	197,457,000
4) Bridge structure							
Gerezani bridge, T girder type	m2	945	1,570,642	673,132	1,484,256,690	636,109,740	2,120,366,430
5) Slope protection work							
Gabion mattress, h = 2.5m	m	165	39,365	354,281	6,495,143	58,456,283	64,951,426
6) Road facilities							
Bus stop	no.	3	576,674	865,011	1,730,022	2,595,033	4,325,055
Road lighting	no.	55	2,242,341	1,207,414	123,328,742	66,407,784	189,736,526
Traffic signal	no.	7	7,012,398	779,155	49,086,784	5,454,088	54,540,872
Lane marking	m	3,900	66	1,256	257,790	4,898,010	5,155,800
Guard rail	m	390	0	426,686	0	166,407,540	166,407,540
A.2 Sub-total of 1) to 6)					2,324,031,839	2,777,157,023	5,101,188,862
A.3 Preparatory works (7% of A.1 and A.2)					1,063,833,036	623,657,626	1,687,490,662
Total Construction Cost					16,261,447,836	9,533,052,277	25,794,500,113
B. Engineering Services Cost							
Detailed design & Supervision (7% of A)					1,138,301,349	667,313,659	1,805,615,008
C. Contingency							
Price escalation & Physical change (10% of A)					1,626,144,784	953,305,228	2,579,450,011
D. Government Administration Cost							
Cost for house compensation and replacement of public utilities					0	2,684,339,000	2,684,339,000
Administration cost (1% of A)					0	257,945,001	257,945,001
Grand Total (A + B + C + D)					19,025,893,968	14,095,955,165	33,121,849,133

7.4 Maintenance Cost

The road maintenance work is divided into two categories, i.e., (i) routine maintenance work and (ii) periodic maintenance work. The costs required for each type of maintenance work are estimated as described hereinafter.

7.4.1 Routine Maintenance Cost

The routine maintenance consists of the following three categories:

(i) Operation cost : The costs for electricity for road lighting, signal operation, etc.
(ii) Cleaning cost : The costs for cleaning the road surface, drainage facilities, traffic sign boards, etc.
(iii) Repairing cost : The costs for pavement repair, overlays, painting of road markings and safety, etc.

The average annual routine maintenance cost spend by the TANROADS in the past years is roughly estimated at Tshs 3,784,000 per km for a 4-lane asphalt pavement road. Therefore, the total routine maintenance cost for each option is estimated as follows:

(1) Option A, C

1.30 km with 4-lanes (Bandari/ Gerezani roads) + 0.53 km with 2-lanes (Flyover at Nyerere road) = 1.3 km x 3,784,000 Tshs/km + 0.53 km x 1,892,000 Tshs = 5,922,000 Tshs

(2) Option B

1.30 km w9,000 Tshs ith 4-lanes (Bandari/ Gerezani roads) + 1.45 km with 4-lanes (Sokoine road) + 0.53 km with 2-lanes (Flyover at Nyerere road) = 2.75 km x 3,784,000 Tshs/km + 0.53 km x 1,892,000 Tshs = 11,409,000 Tshs

(3) Option D

1.30 km with 4-lanes (Bandari/ Gerezani roads) + 0.53 km with 2-lanes (Port crossing bridge) + 0.37 km with 4-lanes (Access road) = 1.67 km x 3,784,000 Tshs/km + 0.53 km x 1,892,000 Tshs = 7,322,000 Tshs

7.4.2 Periodic Maintenance Cost

The pavement design for the project is made covering a life period of 15 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 with 7 cm of asphalt concrete is planned to conduct at 15 years intervals after completion of the project. The required costs of the overlay for each option are estimated as follows:

(1) Option A, C

29,000 Tshs/m^2 (unit cost of the overlay) x 29,835 m^2 (total pavement area) = 865,215,000 Tshs

(2) Option B

29,000 Tshs/m^2 (unit cost of the overlay) x 57,385 m^2 (total pavement area) = 1,664,165,000 Tshs

(3) Option D

29,000 Tshs/m^2 (unit cost of the overlay) x 60,866 m^2 (total pavement area) = 1,765,114,000 Tshs

Chapter 8 Implementation Plan

8.1 Executing Agency

TANROADS shall be responsible for implementation of the project. The required house compensation and replacement of public utilities should be conducted by TANROADS prior to the commencement of the construction works.

8.2 Implementation Schedule

8.2.1 Option A, C

The implementation schedule is made taking into consideration the following periods; (i) basic design/ detailed design stage, (ii) bidding and contract, and (iii) construction schedule. The total period required for the basic design/ detailed design stage and the bidding and contract is estimated at 12 months, while the total construction period is estimated at 24 months as mentioned in the preceding Section 6.4 Construction Period.

As a result, the implementation schedule was made based on the assumption that the order to commence would be issued in January of the 2nd year. The proposed implementation schedule is summarized below:

Work Item	Duration (month)	1st Year 2009	2nd Year 2010	3rd Year 2011	4th Year 2012
1) Basic Design/ Detailed Design Stage	9.0				
2) Bidding and Contract	3.0				
3) Preparatory Works	3.0		Order to Commence		
4) Widening of Bandari/ Gerezani Roads including Gerezani Bridge (Total length = 1,300 m with 6 lanes)	21.0				
5) Flyover at Nyerere (Bridge length = 260 m, Approach length = 265 m, with 2 lanes)	18.0				

Figure 8.2.1 Proposed Implementation Schedule (Oprion A, C)

8.2.2 Option B

The implementation schedule is made taking into consideration the following periods; (i) basic design/ detailed design stage, (ii) bidding and contract, and (iii) construction schedule. The total period required for the basic design/ detailed design stage and the bidding and contract is estimated at 12 months, while the total construction period is estimated at 30 months as mentioned in the preceding Section 6.4 Construction Period.

As a result, the implementation schedule was made based on the assumption that the order to commence would be issued in January of the 2nd year. The proposed implementation schedule is summarized below:

Work Item	Duration (month)	1st Year 2009	2nd Year 2010	3rd Year 2011	4th Year 2012
1) Basic Design/ Detailed Design Stage	9.0				
2) Bidding and Contract	3.0				
3) Preparatory Works	3.0	Order to Commence			
4) Widening of Bandari/ Gerezani/ Sokoine Roads including Gerezani Bridge (Length = 1,300 m with 6 lanes, Length = 1,450 m with 4 lanes)	27.0				
5) Flyover at Nyerere (Bridge length = 260 m, Approach length = 265 m, with 2 lanes)	18.0				

Figure 8.2.2 Proposed Implementation Schedule (Option B)

8.2.3 Option D

The implementation schedule is made taking into consideration the following periods; (i) basic design/ detailed design stage, (ii) bidding and contract, and (iii) construction schedule. The total period required for the basic design/ detailed design stage and the bidding and contract is estimated at 12 months, while the total construction period is estimated at 36 months as mentioned in the preceding Section 6.4 Construction Period.

As a result, the implementation schedule was made based on the assumption that the order to commence would be issued in January of the 2nd year. The proposed implementation schedule is summarized below:

Work Item	Duration (month)	1st Year 2009	2nd Year 2010	3rd Year 2011	4th Year 2012
1) Basic Design/ Detailed Design Stage	9.0				
2) Bidding and Contract	3.0				
3) Preparatory Works	3.0	Order to Commence			
4) Widening of Bandari/ Gerezani Roads including Gerezani Bridge (Total length = 1,300 m with 4 lanes)	21.0				
5) Port Crossing Bridge (Bridge length = 392 m, Approach length = 140 m, with 2 lanes)	33.0				

Figure 8.2.3 Proposed Implementation Schedule (Option D)

8.3 Annual Disbursement Schedule

8.3.1 Option A, C

The annual disbursement schedule is made in accordance with the project cost (Option A, C) and the proposed implementation schedule (Option A, C), and is summarized below:

Table 8.3.1 Annual Disbursement Schedule (Option A, C)

Description	F.C. (million Tshs)					L.C. (million Tshs)				
	2,009	2,010	2,011	2,012	Total	2,009	2,010	2,011	2,012	Total
A. Construction Cost	0	3,924	3,924	0	7,848	0	3,031	3,031	0	6,062
B. Engineering Service Cost	275	137	137	0	549	212	106	106	0	424
C. Contingency	0	392	392	0	785	0	303	303	0	606
D. Government Administration Cost	0	0	0	0	0	2,312	2,312	46	0	4,669
Total	275	4,454	4,454	0	9,182	2,524	5,752	3,486	0	11,762

8.3.2 Option B

The annual disbursement schedule is made in accordance with the project cost (Option B) and the proposed implementation schedule (Option B), and is summarized below:

Table 8.3.2 Annual Disbursement Schedule (Option B)

Description	F.C. (million Tshs)					L.C. (million Tshs)				
	2,009	2,010	2,011	2,012	Total	2,009	2,010	2,011	2,012	Total
A. Construction Cost	0	3,370	3,370	1,685	8,425	0	3,286	3,286	1,643	8,214
B. Engineering Service Cost	295	118	118	59	590	287	115	115	57	575
C. Contingency	0	337	337	169	843	0	329	329	164	821
D. Government Administration Cost	0	0	0	0	0	3,514	3,514	48	24	7,100
Total	295	3,825	3,825	1,912	9,857	3,802	7,243	3,777	1,888	16,710

8.3.3 Option D

The annual disbursement schedule is made in accordance with the project cost (Option D) and the proposed implementation schedule (Option D), and is summarized in **Table 8.3.3**.

Table 8.3.3 Annual Disbursement Schedule (Option D)

Description	F.C. (million Tshs)					L.C. (million Tshs)				
	2,009	2,010	2,011	2,012	Total	2,009	2,010	2,011	2,012	Total
A. Construction Cost	0	6,517	5,453	4,291	16,261	0	4,056	3,433	2,044	9,533
B. Engineering Service Cost	569	228	228	114	1,138	334	133	133	67	667
C. Contingency	0	652	545	429	1,626	0	406	343	204	953
D. Government Administration Cost	0	0	0	0	0	1,407	1,407	64	64	2,942
Total	569	7,396	6,226	4,834	19,026	1,740	6,002	3,974	2,380	14,096

Chapter 9 Environmental Study

9.1 Introduction

Technical site inspections were carried out during July, October and November of 2007. Based on reviews of current reports and major findings obtained from these technical site inspections, the initial environmental examination of selected pre-F/S project is carried out, and potential environmental issues associated with the implementation (IEE) of selected pre-feasibility project are summarized. Basically, the examination is carried out for following two scenarios: i.e., (i) Do - Nothing scenario, and (ii) Do - scenario. Under Do - scenario, possible negative environmental impacts to be caused during and/after improvement works are of concern. Upon reviewing the engineering feature of Gerezani Area Transport Enhancement project, this project can be separated into following two sub-components; i.e., (i) road improvement and widening of existing Bandari-Gerezani-Sokoine road network (Options A, B, C and D), and (ii) construction of the harbor crossing bridge (Option D) for the evaluation purpose. So, based on this categorization, two separate IEEs are conducted within this study.

9.2 Initial Environmental Examination

9.2.1 Bandari - Gerezani – Sokoine Road Improvement Project Component (Options A, B, C and D)

Entire project routes of this project component (Options A, B, C and D) are located at the coastal lowland terrain along Krasini Creek. Existing roads are always congested, and, in particular, road congestions around morning and evening peaks are worse. Depending the current land use of the surrounding environment, this project site can be categorized into following two sections further; i.e., (i) mixed industrial/commercial area along two-lane Bandari Road, and (ii) mixed commercial/residential area along Gerezani and Sokoine Roads. Current road spaces are not wide enough for the implementation of the proposed road improvement project, so that it is likely that certain amounts of expropriation shall be taken.

There are several factories and/or storage facilities along two-lane Bandari Roads. There is one port entrance gate, connecting Tanzania Port facilities, along the adjacent Nelson Mandela Road. This port entrance is easily accessible to and from both Kilwa and Bandari Roads. So, many heavy trucks such as tank lorries and/or trailers are circulating around this port entrance (see **Figure 9.2.1**). Currently, road improvement work is on-going at the adjacent Kilwa Road while the adjacent 2-lane Nelson Mandela Road may be improved to 4-lane in the long term (not confirmed yet, as of November 2007), so that the engineering design of each road improvement projects, proposed within all options, shall be compatible with both on-going Kilwa road improvement project and future Nelson Mandela road improvement plan.

There are several roadside vegetations, one railway crossing point and towers of transmission power line along Bandari Road. Several street vendors are doing their business along this road.

Most of surrounding area along Gerezani Road is used as the residential complex for railway company's employees (see **Figure 9.2.2**). Also, there is several railway company related facilities such as Railway Resort Club. Several street vendors are doing their business along this road, too.

A flyover will run through a four-legged, signaled intersection of Nyerere and Gerezani Roads (**see Figure 9.2.5**, Options A, B and C). The current land use of surrounding environment is classified as a mixed commercial/residential area and there are several buildings around this intersection. There is a bus station around a future Kariakoo BRT station site, and many daladala buses are circulating and parking around this area (see **Figure 9.2.6**). There is a railway crossing point, adjacent to this intersection, and a proposed flyover will have to have an enough vertical clearance not to disturb future railway cargo transport at this point.

There is a Gerezani floodplain lowland, bounded by Bandari, Gerezani Roads and Tanzania Port (see **Figure 9.2.3**). The maximum vertical difference between the current road shoulder of Gerezani Road and the lowland ground surface is of approximately 8 meters. Southern half of this lowland area is used as the railway yard, connecting to the port facilities while local people cultivate remaining half and use as vegetation fields. There are many natural springs (confined and un-confined ones, see **Figure 9.2.4**),where water for the irrigation is always available to vegetation fields. Small wetland bush exists and several birds occur therein. Water, pouring from those springs seems to be clean and occurrences of several aquatic faunal species such as small fishes are observed at the nearby creeks. There are several irrigation channels across this lowland vegetation area. In the past, neither regional flooding nor inundation occurred around this lowland area during the every rainy season [Njawoka, personal communication, 2007]. Within the interviews with local people, it was also found that there was a groundwater pumping station used for a local beer company in the past. Currently, this pumping station is not used any more, mainly due to a recent regional groundwater contamination problem.

Between a railroad crossing point located near to BP office and Bandari-Gerezani roundabout, there is an embankment with a bridge crossing the railway yard. Several drainage facilities for the road

surface run-off water are attached at both road shoulders along this embankment. Its slope protection does not seem to be appropriate and several traces of on-going minor erosion are recognized. Small creek, named Gerezani River, used to run through this lowland, is crossing this embankment via a buried channel (partially observable at the lowland floodplain), and its flow seems to connect somewhere in the adjacent downstream side (i.e., Tanzania Port).

Sokoine Road runs through the coastal area of Dar Es Salaam CBD (see **Figure 9.2.7**), and both Options B and C will run through this road. Many vehicles such as daladala buses and passenger cars are circulating to and from CBD of Dar Es Salaam. Along this road, a traffic police station, a daladala bus depot, several governmental buildings such as DCC and Tanzania Railway Station exist. Several road widening will be taken in Option B along Sokoine Road while no road widening activity but one-way traffic control (toward CBD direction only) is to be imposed in Option C.

No illegal squatter areas exist around this site. No school, church and/or hospital, that would prefer calm environment exist. No historical and/or cultural sites exist. **Table 9.2.1** summarizes the preliminary environmental evaluation of the Bandari - Gerezani – Sokoine Road Improvement Project. It is noted that evaluation results, "U", such as examination results for the air quality, noise and vibration during the operation phase indicate that these environmental conditions highly depend on the future traffic demand forecast results, road structure, in particular, pavement conditions, and/or entire road design system, that are unknown at this moment (as of December 2007). Those evaluations may be possible after those pending issues are solved later.

Table 9.2.1 Initial Environmental Examination (Bandari-Gerezani –Sokoine Road Improvement)

Env. Factor	Descriptions of Impact		Do nothing	Do project			
				OpA	OpB	OpC	OpD
1. Air quality	Increased roadside air pollution during; (Bandari- Gerezani)	Construction	C	A	A	A	A
		Operation	B	U	U	U	U
	Increased roadside air pollution during; (Sokoine)	Construction	C	C	A	B	C
		Operation	B	U	U	U	U
	Increased roadside air pollution during; (Kariakoo)	Construction	C	A	A	A	C
		Operation	B	U	U	U	U
2. Water Quality	Risk of pollution to major tributaries and/or aquifer.	Construction	D	B	B	B	B
		Operation	D	D	D	D	D
3. Soil and sedimentation	Potential for soil erosion (e.g., slope of road embankment).	Construction	C	B	B	B	B
		Operation	C	C	C	C	C
	Occurrence of new sedimentation at downstream side.	Construction	D	C	C	C	C
		Operation	D	D	D	D	D
4. Waste Disposal	Generation of large amounts of construction wastes.		D	B	B	B	B
5. Noise/ Vibration	Increased roadside noise and vibration during (Bandari – Gerezani)	Construction	C	B	B	B	B
		Operation	B	U	U	U	U
	Increased roadside noise and vibration during (Sokoine)	Construction	C	C	A	B	C
		Operation	B	U	U	U	U
	Increased roadside noise and vibration during (Kariakoo)	Construction	C	A	A	A	C
		Operation	B	U	U	U	U
6. Ground Subsidence	Potential of large-scale consolidation due to earthwork		D	C	C	C	C
7. Bad smell	Potential of newly creation of bad smell.		D	D	D	D	D
8. Topography and Geology	Partial road inundation due to poor drainage of road surface run-off water		C	D	D	D	D
	Disturbance of local drainage system.	Construction	C	B	B	B	B
		Operation	C	D	D	D	D
9. River bed	Disturbance to river bed condition.		D	C	C	C	C
10. Fauna/ flora	Destruction of riverside/floodplain vegetation		D	D	D	D	D
	Destruction of roadside vegetation.		D	B	B	B	B
	Disturbance to bird habitats or floodplain habitats.		D	C	C	C	C
	Disturbance to aquatic ecosystem/or habitats.		D	D	D	D	D
11. Water Resources	Water quality degradation (groundwater).		D	C	C	C	C
	Disturbance to regional groundwater flow.		D	C	D	D	D
12. Accidents	Potential of increased traffic accidents.		C	U	U	U	U
	Temporal Traffic Jam during Construction (Bandari & Gerezani).		D	A	A	A	A
	Increased risk of J-walk of widened road after Construction (Bandari-Gerezani).		C	B	B	B	B
	Temporal Traffic Jam during Construction (Sokoine).		D	C	A	B	C
	Temporal Traffic Jam during Construction (Kariakoo)		D	A	A	A	D
13. Global warming	Increased CO_2 emission.		U	U	U	U	U

Note A: significant, B: major, C: minor, D: less significant, U: Unknown

Table 9.2.1 Initial Environmental Examination (Bandari-Gerezani– Sokoine Road Improvement: continued)

Env. Factor	Descriptions of Impact		Do nothing	Do project			
				OpA	OpB	OpC	OpD
14. Involuntary Resettlement	Land (agricultural lands) expropriation due to construction (Bandari & Gerezani)		D	A	A	A	A
	Land expropriation due to construction (Sokoine)		D	D	A	D	D
	Land expropriation due to construction (Kariakoo)		D	B	B	B	D
	Demolition of roadside houses (Bandari & Gerezani).		D	A	A	A	A
	Demolition of roadside houses (Sokoine)		D	D	A	D	C
	Demolition of roadside houses (Kariakoo)		D	B	B	B	D
	Demolition of illegal squatters' lots.		D	D	D	D	D
15. Local Economy	Possible impact on local employment and livelihood (Bandari & Gerezani)		D	C	C	C	C
	Possible impact on local employment and livelihood (Sokoine)		D	D	B	C	C
	Possible impact on local employment and livelihood (Kariakoo)		D	B	B	B	D
16. Land use and Utilization of local Resources	Conflict with current local land use plan (TPA and/or Railway Authority)		D	B	B	B	B
	Conflict with local development plans (TPA and/or Railway Authority)		D	B	B	B	B
	Establish engineering integrity with on-going Kilwa Road Improvement Project.		A	A	A	A	A
	Establish engineering integrity with future possible Nelson Mandela Road Improvement Project.		A	A	A	A	A
17. Social Institutions	Possible impact on social infrastructure & local decision-making system.		D	D	D	D	D
	Community separation due to the widened road and increased future traffic volume after Construction (Bandari-Gerezani).		D	B	B	B	B
18. Existing social infrastructures and services	Possible Impact on public transport system (Bandari & Gerezani)	Construction	D	B	B	B	B
		Operation	D	U	U	U	U
	Possible Impact on public transport system (Sokoine)	Construction	D	D	A	B	C
		Operation	D	U	U	U	U
	Possible Impact on local transport system (Kariakoo)	Construction	D	A	A	A	D
		Operation	D	U	U	U	U
	Conflict with current local energy/communication/water supply system (e.g., power line cable and towers)		D	B	B	B	B
19. The poor, indigenous of ethnic group	Existence of ethnic minority around the site.		D	D	D	D	D
20. Mis- distribution of benefit & damage	Risk of possible damages/or negative impacts concentration/or localization.		D	D	D	D	D
21. Local Conflict of interests	Conflicts between regional environmental conservation and development.		D	D	D	D	D

Table 9.2.1 Initial Environmental Examination (Bandari-Gerezani– Sokoine Road Improvement: continued)

Env. Factor	Descriptions of Impact	Do nothing	Do project			
			OpA	OpB	OpC	OpD
22. Gender	Risk of WID-related issues	D	D	D	D	D
23. Children's right	Risk of illegal child labors (e.g., street vender).	D	D	D	D	D
24. Cultural Heritage	Conflict with the setting of historical, cultural or monumental sites.	D	D	D	D	D
25. Infectious Disease	Risk of Dengue, Malaria and other Insect-borne diseases for construction workers.	D	B	B	B	B
	Risk of HIV/AIDS	D	C	C	C	C

Note A: significant, B: major, C: minor, D: less significant, U: Unknown

Figure 9.2.1 Traffic Condition along Bandari Road

Figure 9.2.2 Traffic Condition along Gerezani Road

Figure 9.2.3 Gerezani Floodplain Lowland Area

Figure 9.2.4 Well (unconfined) at Gerezani Lowland Area

Figure 9.2.5 Intersection of Nerere and Gerezani Roads

Figure 9.2.6 Current Roadside Condition around Future Kariakoo BRT Station Site

Figure 9.2.7 Current traffic condition of Sokoine Road

9.2.2 Harbor Crossing Bridge Construction Project – Option D

Tanzania Port is located around the ex-estuary of Gerezani River, and most of this harbor crossing route (Option D) will run through the inside of this Tanzania Port Facilities on where a busy port operation is on-going and many trucks are circulating (see **Figure 9.2.8**). Beside those heavy vehicles, several passenger cars are running to and/from entrance gates (note: there are three gates to get into this port) for the short-cut purpose. Many port facilities such as storages, control centers and railroad lines exist (see **Figure 9.2.9**), and TPA is planning to have a multi-story parking facility, to be located near the project route (TPA, personal communication, 2007). Basically, the port-wide security of Tanzania Port is very strict and entire port facilities are off-limit.

Two-lane approach road at the CBD-side will run in parallel along the existing 2-lane road along that several office buildings such as the police station exist (see Figure **9.2.10**). So, it is likely that expropriation would be required for the construction of this approach road.

Similarly, approach road at Kilwa-side will directly hit some of port facilities (see Figure **9.2.11**) and will connect to the proposed harbor crossing. It is highly likely that the demolition of existing port facilities is necessary for this approach road construction. As mentioned in previous section, a road improvement work is on-going at adjacent Kilwa Road, so that the engineering design of this selected project shall be compatible with this Kilwa road improvement project.

No major tributary is running through and/or nearby the project route, but it is likely that there is a buried channel/or pipe that receives upstream Gerezani River within the current port facility. No important flora/fauna occurs. No illegal squatter areas exist around this site. No school, church and/or hospital, that would prefer calm environment exist. No historical and/or cultural sites exist. **Table 9.2.1** summarizes the preliminary environmental evaluation of the Harbor Crossing Bridge Construction Project. It is noted that evaluation results, "U", such as examination results for the air quality, noise and vibration during the operation phase indicate that these environmental conditions highly depend on future traffic demand forecast results, road structure, in particular, pavement conditions, and/or entire road design system, that are unknown at this moment (as of December 2007). Those evaluations may be possible after those pending issues are solved later.

Table 9.2.2 Initial Environmental Examination (Harbor Crossing – Option D)

Environmental Factor	Descriptions of Impact		Do nothing	Do project
1. Air quality	Increased roadside air pollution during;	Construction	C	B
		Operation	C	U
2. Water Quality	Risk of pollution to nearest coastline during;	Construction	D	C
		Operation	D	D
3. Soil and sedimentation	Potential for soil erosion (e.g., slope of road embankment).		D	C
	Occurrence of new sedimentation at downstream side.		D	D
4. Waste Disposal	Generation of large amounts of construction wastes.		D	B
5. Noise/Vibration	Increased roadside noise and vibration during;	Construction	C	B
		Operation	C	U
6. Ground Subsidence	Potential of large-scale consolidation due to earthwork		D	B
7. Bad smell	Potential of newly creation of bad smell.		D	D
8. Topography and Geology	Partial road inundation due to poor drainage of road surface run-off water		C	D
	Enhanced coastline erosion/scouring .		D	D
	Disturbance of local drainage system	Construction	C	B
		Operation	C	D
9. River bed	Disturbance to river bed condition.		D	D
10. Fauna/flora	Destruction of floodplain vegetation		D	D
	Destruction of roadside vegetation.		D	D
	Disturbance to bird habitats or floodplain habitats.		D	D
	Disturbance to aquatic ecosystem/or habitats.		D	D
11. Water Resources	Water quality degradation.		D	D
	Disturbance to regional groundwater flow.		D	D
12. Accidents	Potential of increased traffic accidents.		C	U
	Temporal Traffic Jam during Construction.		D	B
13. Global warming	Increased CO_2 emission.		U	U
14. Involuntary Resettlement	Temporal use of port land during construction (e.g., set-up of construction yard)		D	B
	Land Expropriation due to construction		D	B
	Demolition of roadside houses (approach road).		D	B
	Demolition of illegal squatters' lots.		D	D
15. Local Economy	Possible impact on local employment and livelihood		D	D
16. Land use and Utilization of local Resources	Conflict with current local land use plan (TPA)		D	A
	Establish engineering integrity with on-going Kilwa Road Improvement Project.		D	A
	Establish engineering integrity with future possible Nelson Mandela Road Improvement Project.		D	A

Table 9.2.2 Initial Environmental Examination (Harbor Crossing – Option D, continued)

Environmental Factor	Descriptions of Impact		Do nothing	Do project
17. Social Institutions	Temporal interference with port security during construction		D	B
	Other possible Impact on social infrastructure and local decision-making institutions.		D	D
18. Existing social infrastructures and services	Conflict with current local transport system during	Construction	D	B
		Operation	D	D
	Conflict with current local energy/ communication/water supply system (e.g., port operation).		D	A
19. the poor, indigenous of ethnic group	Existence of ethnic minority around the site.		D	D
20. Misdistribution of benefit and damage	Risk of possible damages/or negative impacts concentration/or localization (e.g., TPA's loss of profit due to the temporal disturbance to be caused by construction activity).		D	B
21. Local Conflict of interests	Conflicts between regional environmental conservation and development.		D	D
22. Gender	Risk of WID-related issues		D	D
23. Children's right	Risk of illegal child labors (e.g., street vender).		D	D
24. Cultural Heritage	Conflict with the setting of historical, cultural or monumental sites.		D	D
25. Infectious Disease	Risk of Dengue, Malaria and other Insect-borne diseases for construction workers.		D	B
	Risk of HIV/AIDS		D	C

Note A: significant, B: major, C: minor, D: less significant, U: Unknown

Note: Trailer is climbing southern approach slope connecting to Gate #3.

Figure 9.2.8 Inside of Tanzania Port

Note: Several railway lines exist inside of this port.

Figure 9.2.9 Inside of Tanzania Port

Note: Proposed northern (i.e., CBD-side) approach road may run in parallel to this road.

Figure 9.2.10 Existing Port access Road connecting to Gate #1

Note: Proposed southern (i.e., Kilwa-side) approach road will hit this port building directly.

Figure 9.2.11 Tanzania Port Facilities on the Project Route.

9.3 Summary of IEE

Here, based on IEE results of the selected pre-feasibility projects, possible environmental impacts, commonly identified for two project components, are summarized in **Table 9.3.1**. It is noted that most of identified negative impacts to be caused by selected pre-F/S projects are evaluated as either of B or C. Also, most of B evaluations are related with construction activities, so it can be said those negative impacts are temporal ones. **Tables 9.3.2** and **9.3.3** summarize more detailed descriptions of each potential negative impacts for both "Do - Nothing" and "Do - Project" scenarios, identified for two selected pre-F/S projects, respectively.

Table 9.3.1 Summary of Potential Negative Impacts

	Project Name		Potential Negative Impacts					
			Do Nothing			Do Project		
			A	B	C	A	B	C
1	Bandari - Gerezani – Sokoine	**Op. A**	2	6	12	10	16	12
		Op. B				16	17	8
		Op. C				10	20	9
		Op. D				6	13	16
2	Harbor Crossing (**Op. D**)		0	0	8	4	13	3
2'	**Option D** (total)		2	7	20	10	26	19

Note: The evaluation summary of **Option D** (total) = Bandari-Gerezani-Sokoine (**Op. D**) + Harbor Crossing (**Op. D**)

Table 9.3.2 Breakdown of Each Potential Impacts (Bandari – Gerezani - Sokoine)

	Environmental Factors	Remarks of Possible Impacts
1	Air Quality	1. Increased roadside air quality degradation during construction 2. Future roadside air quality degradation after construction.
2	Water Quality	1. Risk of pollution to major tributaries and/or aquifer.
3	Soil and Sedimentation	1. Potential for soil erosion during construction. 2. Occurrence of new sedimentation at downstream side during construction.
4	Waste Disposal	1. Preparation of excavated soil dump site. 2. Proper treatment of industrial wastes to be generated during construction period.
5	Noise/Vibration	1. Noise and vibration during construction period. 2. Future roadside noise and vibration after construction.
6	Subsidence	Less significant
7	Bad Smell	Less significant
8	Topography/ Geology	1. Disturbance of local drainage system during construction.
9	River Bed	Less significant
10	Flora/Fauna	1. Destruction/or relocation of roadside vegetation.
11	Water Resources	1. Water quality degradation (groundwater). 2. Disturbance to regional groundwater flow.
12	Accidents	1. Potential of increased traffic accidents during construction period. 2. Increased risk of J-walk of widened road after Construction.
13	Global Warming	Unknown, CO_2 emission loading may be reduced.

Table 9.3.2 Summary of Possible Impacts (Bandari – Gerezani - Sokoine, continued)

	Environmental Factor	Remarks of Possible Impact
14	Involuntary Resettlement	1. Land (office/housing/agricultural lands) expropriation due to construction 2. Demolition of roadside houses
15	Local Economy	Less significant
16	Land use and Utilization of local Resources	1. Conflict with current local land use and development plans (TPA and/or Railway Authority) 2. Establish engineering integrity with both on-going Kilwa Road Improvement Project and future Nelson Mandela Road Improvement One.
17	Social Institutions	1. Community separation due to the widened road and increased future traffic volume after Construction.
18	Existing social infrastructures and services	1. Conflict with current local transport system during construction. 2. Conflict with current local energy/communication/water supply system (power line cable and towers).
19	Poor, indigenous of ethnic group	Less significant
20	Misdistribution of benefit and damage	Less significant
21	Local Conflict of interests	Less significant
22	Gender	Less significant
23	Children's right	Less significant
24	Cultural Heritage	Less significant.
25	Infectious Disease	1. Risk of Dengue, Malaria and other Insect-borne diseases for construction workers.

Table 9.3.3 Breakdown of Each Potential Impacts (Harbor Crossing –Option D)

	Environmental Factors	Remarks of Possible Impacts
1	Air Quality	1. Increased roadside air quality degradation during construction 2. Future roadside air quality degradation after construction.
2	Water Quality	Less significant.
3	Soil and Sedimentation	Less Significant.
4	Waste Disposal	1. Preparation of excavated soil dump site. 2. Proper treatment of industrial wastes to be generated during construction period.
5	Noise/Vibration	1. Noise and vibration during construction period. 2. Future roadside noise and vibration after construction.
6	Subsidence	1. Consolidation due to the approach road construction.
7	Bad Smell	Less significant
8	Topography/ Geology	Less significant.
9	River Bed	Less significant
10	Flora/Fauna	Less significant
11	Water Resources	Less significant.
12	Accidents	1. Potential of increased traffic accidents during construction period.
13	Global Warming	Unknown, CO_2 emission loading may be reduced.

Table 9.3.3 Summary of Possible Impacts (Harbor Crossing – Option D, continued)

	Environmental Factor	Remarks of Possible Impact
14	Involuntary Resettlement	1. Temporal use of port land during construction (e.g., set-up of construction yard). 2. Demolition of roadside houses (approach road).
15	Local Economy	Less significant
16	Land use and Utilization of local Resources	1. Conflict with current local land use plan (TPA). 2. Establish engineering integrity with both on-going Kilwa Road Improvement Project and future Nelson Mandela Road Improvement One.
17	Social Institutions	1. Temporal interference with port security during construction
18	Existing social infrastructures and services	1. Conflict with current local transport system during construction. 2. Conflict with current local energy/communication/water supply system (e.g., port operation).
19	Poor, indigenous of ethnic group	Less significant
20	Misdistribution of benefit and damage	1. Loss of profit due to the temporal construction-related disturbance.
21	Local Conflict of interests	Less significant
22	Gender	Less significant
23	Children's right	Less significant
24	Cultural Heritage	Less significant.
25	Infectious Disease	1. Risk of Dengue, Malaria and other Insect-borne diseases for construction workers.

Chapter10 Project Evaluation

10.1 Introduction

In addition to the current traffic congestion in Gerezani area, concerns are arisen by the implementation of the on-going Kilwa road development work and the Phase I plan of the BRT Corridor Project[1]. Thus this Gerezani Area Improvement project has selected as a priority project by the steering committee for Transport Policy and System Development Master Plan. Congestion at the Gerezani area has brought and will bring a huge negative impact to Dar es Salaam. In fact without capacity improvement of Bandari road the current Kilwa road widening project will not work as expected.

The project will be evaluated from the view point of economic consideration on the basis of future traffic demand to confirm its economic viability. A conventional economic evaluation of the project, that is, cost benefit analysis is made by comparing with the project and without the project cases.

10.2 Basic Assumptions for Economic Analysis

1) BRT Operation Options

As is discussed in the previous chapters, four options, Option A, B, C and D, relating to the BRT operation at Gerezani area are suggested. It is not practical to distinguish the benefit of BRT solely in the Gerezani area and it is safe to say that the economic benefit from the BRT implementation in each option is approximately the same because of little difference in operation length. At the same time, in terms of economic benefit of the road improvement options, expected benefit in option A, B, C and D is considered as the same because of the same development features[2] and their impacts. As a consequence, Option A is considered to be most effective because of the cheapest project cost[3]. Hence economic evaluation will be conducted by the comparison of Option A with the case that the project is not implemented.

2) “With Project” and “Without Project”

While “With Project” means the situation with the implementation of the proposed Option A of the

[1] Refer to page 3 of the Chapter 1, Project Orientation, Pre-Feasibility Study Report - Gerezani Area Transport Enhancement
[2] Refer to Table 5.3.2 Salient Features of Each Option, 5.3 Proposed Preliminary Designs
[3] Section 7.3, Total Project Cost, page 5.

Gerezani area road improvement work, "Without Project" stands for the situation of no such investment. The quantified economic benefits, which would be realized from the implementation of the project, include time saving of travelers including car users and public transport users are defined as the difference of the vehicle travel costs (vehicle time costs) between "With Project" and "Without Project".

3) Implementation schedule

The total period required for the basic design/ detailed design stage and the bidding and contract is estimated at 12 months, while the total construction period is estimated at 24 months. The study assumes that the basic design work starts in January 2009 and the bidding and contract process commence in January 2010. The detail of the implementation schedule is referred to Chapter 6, Construction Plan and Chapter 8, Implementation Plan.

4) Project life

The evaluation period is assumed to be 30 years after the completion; i.e. from 2012 to 2041.

5) Prices

The base year for prices is 2nd of October 2007 and exchange rates are set up as follows:

US$ 1.0 = Tshs 1,271.26 = Yen 116.74

6) Discount Rate

Discount rate is set at 12 %..

10.3 Traffic Demand Forecast

As described in Chapter 4, Traffic Study, traffic demand forecast in 2007, 2015 and 2030 in Gerezani Area are made as a consequence of the traffic analysis with VISSIM soft ware. **Table 10.3.1** and **Table 10.3.2** summarize the daily forecast of vehicle hour from 2007 to 2041. The figures between 2007 and 2015, between 20015 and 2030, and after 2030 are calculated with the average growth rate.

Table 10.3.1 Daily Vehicle Hour Forecast Without Project Case

(vehicle*hour)

	Total Vehicle Hour	Passenger Cars	Dala dala and buses	2 axles Trucks	3 and more axles
2007	3,859	2,357	1,053	423	26
2015	11,955	8,957	1,711	1,152	135
2030	54,844	47,367	3,026	4,087	363
2041	54,844	47,367	3,026	4,087	363

Source: JICA Study Team

Table 10.3.2 Daily Vehicle Hour Forecast With Project Case

(vehicle*hour)

	Daily Volume	Passenger Cars	Dala dala and buses	2 axles Trucks	3 and more axles
2007	3,859	2,357	1,053	423	26
2015	4,438	3,767	50	550	72
2030	18,439	17,216	92	745	386
2041	18,439	17,216	92	745	386

Source: JICA Study Team

10.4 Project Costs

1) Project Costs

The project costs in terms of financial prices are estimated in the process of cost estimates, Chapter 7. **Table 7.4.1** shows the project cost and the cost for the financial analysis, in which tax has been excluded.

2) Maintenance cost

Maintenance cost composed of routine maintenance cost and periodic maintenance cost and is calculated in the process of cost estimates, chapter 7.

3) Estimation of Economic Project Costs

For the economic analysis, all project costs (in financial price) and benefits should be valued at their opportunity cost to the economy. International prices are taken to be the most appropriate measure of opportunity cost. Price distortion intentionally caused by imposition, limited opportunity, etc needs to be adjusted.

Major types of cost for shadow pricing corrections are foreign exchange, taxes, wages and interest and shadow pricing requires large quantities of data and analysis. For this reason, Standard Conversion Factor (SCF) is used as the compatible tool to convert financial prices to economic prices. SCF allows for the general distortion between international and domestic process that is caused by import duties, taxes, subsidies and other non-price distortions to the whole economy. SCF is an index, which converts domestic prices to border prices by adjustment of the distortion of domestic prices.

In the economic analysis, all the costs are classified into the items of trade goods, non-trade goods and transfer items. It is assumed that trade goods are equivalent to the foreign currency portion aggregation of non-trade goods stands for the local currency portion. Transfer item means the portion of taxes. Calculation of SCF and the details are described in 10.1.4 Shadow Pricing section of the Chapter 10 Master Plan Evaluation of the Draft Final Report of the Dar es Salaam Transport Policy and System Development Master Plan.

3) Economic Cost of the Project

By adjusting shadow price factors economic cost of the project is calculated as shown in **Table 10.4.1**.

Table 10.4.1 Project Cost (Gerezani Option A) in Economic Price

Unit :Tshs million

Work Items	Financil Cost			Economic Cost		
	F.C.	L.C.	Total	F.C.	L.C.	Total
A. Construction Cost						
1) Earthwork						
Excavation	132	33	164	132	29	160
Embankment	389	97	486	389	84	473
2) Pavement work				0	0	0
Carriageway	230	1,305	1,535	230	1,134	1,364
Side walk	16	91	107	16	79	95
Median	0	22	22	0	19	19
3) Drainange work				0	0	0
Cross drain	15	134	149	15	117	131
Culvert drain	36	143	178	36	124	160
Ditch drain	20	178	197	20	154	174
4) Bridge structure				0	0	0
Gerezani bridge, T girder type	1,869	801	2,670	1,869	696	2,565
5) Flyover, PC hollow slab type				0	0	0
Bridge portion	4,319	1,851	6,170	4,319	1,609	5,928
Approach portion				0	0	0
Embankment	86	22	108	86	19	105
Retaining wall	92	368	460	92	320	412
Road				0	0	0
Guardrail	0	226	226	0	197	197
Carriageway	22	126	148	22	109	132
Median	0	0	0	0	0	0
6) Slope protection work				0	0	0
Gabion mattress, h = 2.5m	6	58	65	6	51	57
7) Road facilities				0	0	0
Bus stop	2	3	4	2	2	4
Road lighting	58	31	90	58	27	86
Traffic signal	42	5	47	42	4	46
Lane marking	0	5	5	0	4	5
Guard rail	0	166	166	0	145	145
Sub-total of 1) to 7)	7,335	5,665	13,000	7,335	4,923	12,258
8) Preparatory works (7% of Sub-total)	513	397	910	513	345	858
Total Construction Cost	7,848	6,062	13,910	7,848	5,268	13,116
B. Engineering Services Cost				0	0	0
Detailed design & Supervision (7% of A)	549	424	974	549	369	918
C. Contingency				0	0	0
Price escalation & Physical change (10% of A)	785	606	1,391	785	527	1,312
D. Government Administration Cost				0	0	0
House compensation / replacement of public utilities	0	4,530	4,530	0	3,937	3,937
Administration cost (1% of A)	0	139	139	0	121	121
Grand Total (A+B+C+D)	9,182	11,762	20,944	9,182	10,221	19,403

Source: JICA Study Team

10.5 Project Benefits

1) Estimation of the benefits

The benefits that could be expected by the implementation of the project are identified as follows:

Savings to those road users who use the Gerezani Area i.e. passenger cars, Dala dala & buses, 2 axles Trucks and 3 and more axles on roads because of increased speed and capacity on roads

- Personal travel time Saving

The benefit of the BRT solely in the area is hardly obtained and therefore not included in this analysis.

2) Savings

The quantified economic benefits of saving in vehicle operating costs and saving in vehicle time costs are defined as the difference of these costs when comparing the "With Project" and "Without Project"

10.6 Result of Economic Analysis

Based on the above assumptions, economic analysis is conduced with the results in **Table 10.6.1**.

Table 10.6.1 Results of Cost Benefit Analysis

Evaluation Indicator	Result
Net Present Value (NPV) (in Tshs million, discounted at 12%)	66,550
EIRR	32.9%
B/C (discounted at 12%)	7.54

Chapter 11 Recommendations

11.1 General

The importance and necessity of the Gerezani Area Transport Enhancement Project has been confirmed by the steering committee through in-depth discussions made in the steering committee meetings. This preliminary feasibility study report strongly supports the decision of the steering committee in a numerical manner. That is, the economic viability of this project has been confirmed by the conventional benefit cost analysis: the project EIRR will reach at 32.9% which is higher than the normal time preference in those developing countries including Tanzania. Accordingly it is strongly recommended to implement the project as soon as possible because a significant social and economic loss are being generated by this congested road segment.

11.2 Project Implementation Body

As indicated in Chapter 8 of this pre-FS report, TANROADS shall be responsible for the implementation of this project. In fact this road capacity improvement project can be considered an extension of the current Kilwa road widening project. At the same time this project includes the BRT lanes and the BRT exclusive flyover to reach the Kariakoo BRT terminal, thus, DART Agency should also be involved in developing the project.

11.3 Environmental Impact Assessment

This preliminary feasibility study summarizes possible environmental negative impacts caused by this construction work as IEE based on the site survey. From the local perspectives[1], it is mandatory to conduct a full-scale EIA study for any road sector related development projects. Therefore, the implementing agency of this project shall be required to conduct a full-scale EIA study during the preparatory stage of the project and monitor the environmental impacts during the implementation stage. A series of environmental survey and laboratory tests were conducted during the IEE exercise, and can be used as baseline data for a full-scale EIA. The EIA-related tasks of the implementing agencies and other stakeholders are itemized in the following table.

[1] EIA - related fact-finding meeting with Dr. Sosovelo, a senior research fellow of IRC, University of Dar Es Salaam, was held during the study period of the Master Plan Study in November 2007. He is the one of the advisory committee members for the draft preparation of Tanzanian EIA, SEIA and other relevant environmental codes.

Table 11.1 Working Items of EIA Process for the Project

Major EIA Task \ Stakeholders	NEMC	MoID/TANROADs	Communities
1. Project Registration		*	
2. TOR Development for EIA Study	*	*	
3. Public Involvement (e.g., stakeholder meeting)		*	*
4. EIA-TOR Consultation with NEMC, Preparation of EIA- TOR (Final)	*	*	
5. EIA Study		*	
6. Preparation and submission of EIA (D/F) Report		*	
7. Review of submitted EIA (D/F) Report by NEMC, Revising if necessary.	*		
8. Revising submitted EIA (D/F) and Preparation of EIA Final Report		*	
9. Preparation of RAP and EMP		*	
10. Submission of EIA Final Report		*	
11. Public Involvement (e.g., stakeholder meeting)	*		*
12. Review of EIA Final Report by NEMC	*		
13. Notice of Official Environmental Approval	*	*	
14. Environmental Monitoring during construction phase		*	

11.4 Financial Arrangement

One of the obstacles for the immediate implementation of this project is financial arrangement. As indicated in Technical Report 4: Public Finance, the current road sector's budget is very much limited and accordingly very little budget has been allocated to new construction works. Besides, the investment to the urban road sector is much more limited in comparison with those to the national trunk roads. However, towards the world city objectives proposed in the Master Plan, a strategic budgeting approach should be established for the urban transport sector. Especially as the gateway city of Tanzania, budget allocation to Dar es Salaam road system should be given priority.

Within the limited financial sources and current debt situation, it is hard to expect innovative and revolutionary financial solution. However, considering the importance and urgent necessity of the project it is recommended that financial plans analyzed in Chapter 10 include new revenue generation scheme to be considered urgently. Followings are summary of the plans.

1) External Sources

As a HIPC country, the government needs to plan closely with the relevant organizations for the additional debt on the project. Considering the amortization of the existing debt and future development, it is apparent that new debt, at least some roll over, is required. In other words, without new income sources, the debtor cannot suddenly stop all the scheduled annual debt. By balancing the

reduction of the existing debt and new debt, the government might seek additional funding source for the project.

2) Road Funds

As mentioned, increase in road tax revenue is still insufficient to fulfill all the required maintenance work. However, the government is still under consideration on how to use the increased revenue of the tax. There might be a possibility that some part of the revenue to use for the new project.

3) Improvement of Tax System

As described in Chapter 9, Financing Strategy and Plan of the Draft Final Report, Tanzanian tax system has a potential to develop, though it needs huge effort and time.

4) New Revenue Generation Scheme

Some new possible schemes were introduced in chapter 9, Financing Strategy and Plan, in the Draft Final Report. It is up to the government decision which scheme to develop for the Tazara Project.

5) CDM Credit

The Gerezani Area Transport Enhancement project include a very important portion for future BRT operation. For the construction work for BRT there is a possibility to use CDM credit. DART Agency can apply CDM for future BRT system development as indicated in Technical Report 4. In this context, it is highly recommended that TANROADS and DART Agency work closely for this project.

6) Grant aid

Since the preliminary feasibility study for the Gerezani Area Transport Enhancement Project has been conducted already, which indicates preferred BRT operation and associated designs, the basic design and more accurate cost estimates can be prepared in a consequent basic design stage. It is recommended for GOT to try to receive grant aid for this intersection improvement. TANROADS can prepare the grant aid application with this preliminary study for further actions.