# Technical Report 2

# Transport Planning & Development

# PART 2: Traffic Control and Management

# Chapter 6 Traffic Control and Management

Reviews and investigations, as well as extensive discussions with specialists knowledgeable with the urban road sector, have given rise to a series of strategic issues, each of which is associated with unique opportunities and constraints. Previous chapters in this Technical Report 2 address important road sector topics such as the necessity of defining a functional (as opposed to the current administrative) road hierarchy, commercial vehicle needs, evolution of a mid to longer term road network as well as near-term and intersection-specific infrastructure solutions.

There concurrently exists a pressing need to optimize not only infrastructure, but also how infrastructure is used; in particular, the optimization, to the highest degree possible, of current operating practices, parking patterns, traffic regulations, signals and signage as well as enforcement. These topics are reviewed in the current chapter for the road system in general, while the more specialized needs of the CBD are addressed in the subsequent Chapter 7.

It is also noted that organizational issues play a strong current role in traffic control and management and is briefly described in following paragraphs. However, at a more strategic level, one of the key Master Plan recommendations is that, in order to improve what is at present an overlapping and (often) ineffective organizational approach to traffic control and management (as well as for public transport), the formation of a multi-disciplinary and multi-modal DUTA (Dar es Salaam Urban Transport Authority) is strongly urged. All relevant details in this regard are presented in the Master Plan Technical Report 3.

## 6.1 Overview

Various traffic related organizations, institutions and even individuals have been discussing the recent traffic congestion problems of Dar es Salaam. Some notable studies have recently been sponsored by TANROADS[1] and JICA[2], to include the current study. Some of the major issues identified by the past studies are:

[1] Study of Traffic Management on Trunk Roads in Dar Es Salaam Region, op. cit.

[2] *Study on Dar Es Salaam Road Development Planning*, for The Government of the United Republic of Tanzania, by Japan Engineering Consultants and Nippon Koei, sponsored by the Japan International Cooperation Agency, 1995.

- Concentration of the business/commercial/industrial areas in a limited area: the current CBD and rapid expansion of residential areas in the suburban areas;
- Mixture of variety of traffics of different demand/characteristics: international, regional and local travel demand; and
- Deterioration of the urban public transport services.

Most recent reviews have suggested that the present road configuration and network patterns with lack of enough capacity and poor traffic control and management are the major causes of the current traffic congestion problem. In addition, with the increasing population and longer travel distance due to rapid expansion of housing areas in the outskirts of the city, traffic conditions are becoming worse, creating severe traffic congestion on the trunk roads especially in morning and evening peak periods in the city.

There would be some practical policy instruments to tackle with the problems in various fields such as land use control, urban re-generation, more road development, public transport development, and traffic control and management. In fact a wide range of measures have been identified by the past studies to alleviate the traffic congestion in Dar es Salaam, however, implementation of such recommend projects and plans has not yet been realized.

This chapter seeks to establish a strategic policy in the field of traffic control and management, as well as safety, as one of the measures to address the current traffic congestion and associated problems such as environmental deterioration.

## 6.2 Traffic Regulations

In the field of road traffic control and management, the primary policy objective is to develop appropriate institutional and organizational arrangement towards further efficient road use. One of the required actions is **to enhance capacity of the relevant organizations** in order to coordinate the traffic control devices and traffic management tools that are under jurisdiction of different organizations.

Development of a good road traffic legal structure is another necessary action to achieve such requirement. There are two pillars of legal structures among other related laws and acts dealing with traffic control, management and safety*: Road Traffic Act of 1973* as amended, and the *Road Act, 2007.* The former mainly deals with road traffic related regulations and the latter deals with road management from road administrative point of view as the name implies.

The Road Traffic Act contains major regulatory tools for the purpose of ordinary traffic control and management as well as tools for traffic safety. It deals with the power of the Ministry and police for traffic operations and management including setting of traffic signals and signs, traffic markings, restriction of traffic on roads, making regulations of temporary speed restrictions, closure of roads, restriction of use of one-way traffic, setting aside parts of a road as special parking areas and so on.

On the other hand, Roads Act is the tool for the road authority to regulate traffic in case of construction works, maintenance works, and for preserving road structures. This road authority mainly depends on

this Act not only for the maintenance and operation of roads but also even for traffic control and management as a road administration body.

In conclusion, the regulatory structure in Tanzania is relatively well developed, whereas actual implementation of the traffic regulation tools and law enforcement is relatively poor mainly due to lack of man-power and budget.

## 6.3 Organization/Budget/Manpower

Various stakeholders are involved in the sector, details of each being presented in subsequent sections.

### 6.3.1 Ministry of Infrastructure Development

This Ministry has a wide range of responsibilities related to the transport and infrastructure development policy in Tanzania. Traffic control and safety programming are two of the important responsibilities, among others. In the Ministry, there is one organization in charge of traffic management and safety: Road Safety Unit, which makes plans for the traffic management and road safety.

A review[3] of the 2007/08 government budget for transport infrastructure, undertaken during June 2007, concluded "…required funding is about US$ 166 million (210 billion Tsh.) assuming that the whole road network of 78,892 km in maintainable conditions, 65% of which is for trunk and regional roads while 35% is for district, feeder and urban roads. Budgetary allocations for road maintenance funding have been constantly below 40% of the requirements up to 2006/07."

The financial sources of road maintenance come from the road funds managed by the Roads Fund Board, which is to advise the Minister on new sources of road tolls for ensuring an adequate and stable flow of funds. The Road Tolls (Amendment) No. 2 Act 1988 gives the road funds as the following sources:

- All moneys collected as roads tolls imposed on diesel and petrol;
- Transit fees;
- Heavy vehicle licensing;
- Vehicle overloading fees; and
- Other sources determined by the Parliament.

The fuel levy accounts for over 95% of the funds.

Implications based on the 2007/08 budget framework are:

- Less than half of the required maintenance funds have been awarded up to the 2006/07. The additional increase is likely to contribute significantly toward better conditions of roads;

[3] *A Quick Review of the Implication of the 2007/08 Government Budget on Transport Infrastructure Financing in Tanzania,* NM Lema, Associate Professor of Construction Management, University of Dar es Salaam, June 2007

- Backlog maintenance requires about US$ 600 million to rehabilitate roads to bring the network to maintainable level;
- Absorption capacity is low. Though more funding is required in order to improve road maintenance, this must be accompanied by improvements in the capacity of implementation agencies and construction industries; and
- The road network under LGAs is about 50,000 km (mainly rural, district, feeder and urban roads) but receives 30% of the share, in comparison to TANROADS, which has about 28,000 km (mainly trunk and regional roads) receives about 70% of the share. This creates the imbalance of maintenance level between them.

However, it is expected to see better management of traffic in the near future with the increase of allocated budget for road maintenance, which includes expenditures for traffic control and management facilities. The capacity increase of implementation agencies and local governments should be enhanced as well

### 6.3.2 TANROADS

As a road administration body, TANROADS is to prepare guidelines, standards and specifications for road works and performance of road network. Among their road management work, they perform traffic control and management through the activities of controlling overloading of trucks, temporary regulation of traffic during road works, disasters, and so on and regulation of traffic to protect the road structures and surface.

The Agency is headed by the Chief Executive, under which there are four divisions: namely Finance and Administration, Maintenance, Development, and Engineering. The Agency has established offices in twenty-one administrative offices headed by Regional Managers. Total number of staff is 791 comprising 196 professional, 349 skilled, and 246 supporting staff.

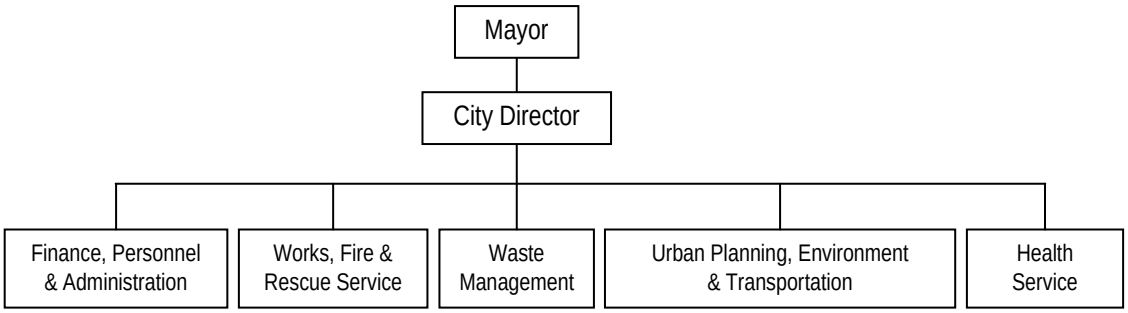
Dar es Salaam Regional Management Office (DRMO) is managing trunk roads and regional roads within Dar es Salaam with 23 staff mainly for the maintenance work. DRMO was allocated 2006/2007 budget of 3,510 million Tsh., in which 997 million Tsh. is for development works and 2,513 million Tsh. for maintenance works. The proposed budget for 2008/2008 is 10,053 million Tsh, which is not finalized yet but almost three times of those in the previous year.

There is one organization in charge of traffic management matters, which is the Road Safety and Environment Section composed of four engineering staff. TANROADS is a responsible body for road operation, install traffic signals, road signs and road markings. This shows far less capacity in dealing with traffic management by TANROADS.

### 6.3.3 Dar es Salaam City Council and Municipalities

Dar es Salaam City Council (DCC) has five departments: namely, Finance, Personnel and Administration Dept., Works, Fire and Rescue Service Dept., Waste Management Dept., Urban

Planning, Environment and Transportation Dept., and Health Service Dept (**Figure 6.3.1**).




Source: JICA Study Team

**Figure 6.3.1 DCC Organizational Structure**

Works, Fire and Rescue Service Department is managing road operation and maintenance. However, the implementation of those services has been handed to three municipalities: Ilala, Kinondoni and Temeke since year 2000. DCC's function in road sector is a coordination body for three municipalities. The number of staff for road engineering department is 4 in DCC, 2 in Ilala, 2 in Kinondoni and 3 in Temeke Municipality.

### 6.3.4 SUMATRA

The mission of SUMATRA is to promote, facilitate and ensure availability of efficient, safe, fair, reliable and environmentally friendly transportation services in the surface and maritime transport sub-sectors.

The SUMATRA Act 2001 sets out the several roles of the Authority. The basis of roles are to seek economic efficiency by effective competition while protecting interests of the consumers, financial viability of suppliers and availability of regulated services to all consumers including low income, rural and disadvantaged consumers.

Among role and functions of the Authority, activities related road transport are licensing to any motor vehicles with carrying capacity of seven persons and above (i.e. bus services). Licensing is expected to ensure that:

- Legitimate buses are in service;
- Well maintained vehicles are is use;
- Loading and unloading should be efficiently conducted at designated bus stop without hindrance to other traffic;
- Driving manner of buses, especially Dala Dala, should follow established rules of the road; and
- Buses should be of recent vintage and maintained in a clean condition.

However, in spite of regulation of the Authority, actual number of buses operating on the roads in Dar es Salaam is estimated to be approximately 6,000 whereas the licensed buses number about 4,500. Dala

Dala buses stop any locations where it is necessary to catch passengers. They drive on the sidewalks when traffic is congested and they stop even on the exclusive left-turning lane at the intersection. Most buses are second-hand and are likely to break down at any moment, which might cause interruption to ordinary traffic on roads. SUMATRA has been aware of the deficiencies caused by Dala Dala bus operation. However, due to lack of staff, actual enforcement in the field is lacking.

### 6.3.5 Police

Police department is the main player of traffic control and management activity on roads. There are about 330 (165 officers x 2 shift) police officers dispatched to intersections and normal sections of roads to observe, control and regulate traffic every morning and evening peak periods as well as during daytime. Information collected during traffic control and management activities is transmitted to the Commander of Police in Dar es Salaam to receive instructions if it is necessary. Besides, police officers on motor bikes and patrol cars have been collecting information. However, the equipment for the purpose of traffic control is limited.

Currently there is one unit in the HQ of Police playing as a role of Commanding Police Center handling emergencies including traffic accidents, crimes etc. This center will be a Traffic Control Center in the future, equipped with a computer, staff, and display panels to see traffic conditions of important intersections in the city.

### 6.3.6 Summary

There are multiple stakeholders that are in charge of traffic control and management; the Ministry of Infrastructure Development in the field of transport policy and planning, TANROADS and DCC and Municipalities in the field of project implementation and maintenance work, Traffic Police for traffic control and enforcement of the traffic regulations, and SUMATRA for regulation and operation of buses. Every organization is facing with the problems of lack of staff, lack of technical capacity, and lack of money.

It should be noted that there has been little coordination between the organizations for the purpose of integrated traffic control and management. Currently there is no such organization that is entirely devoted to the traffic control and management issues in Dar es Salaam. It could be effective to have such authority (Dar es Salaam Urban Transport Authority) that coordinates all disciplines (planning, engineering, etc.) and management of various transport modes. The formation of such an organization is presented in considerable detail in Technical Report 3 of the Master Plan.

Each road administration body such as TANROADS for trunk roads and local governments for urban and local roads are to install and maintain traffic control devices such as traffic signals, signs and markings. Coordination between Ministry of Infrastructure Development, Police Department and local governments are essential and required for effective traffic control and management in the city.

## 6.4 Operational Procedures

According to the past study named the Study of Traffic Management on Trunk Roads in Dar Es Salaam Region[4], it was found out in terms of road and operation conditions that;

- The trunk road network is a radial arterial road network originating from the central business district. The proper management and maintenance of the network is vital for economic growth of Dar es Salaam.
- Sections of this trunk road network, which consists predominantly of one lane per direction, are highly congested and low operation speed prevail during peak times i.e. 20 to 30 km/h. These operating speeds generally equate to Level of Service D (or less) according to the US *Highway Capacity Manual*.

### 6.4.1 Traffic Control at Intersections

Severe congestion prevails at many intersections on the trunk road network during morning and evening peak periods due to problems related to intersection traffic control. Some traffic signals are not working or working only during a certain period because of no maintenance, some are not properly controlled and some are completely obsolete having been installed long time ago. The signals in Dar es Salaam are not programmed to respond to demand; in stead, operated by fixed cycle time. Although the demand exceeds the capacity of a certain approach, the allocated green time remains same and thus creating congestion on the relevant approach(es).

Intersections without traffic signals were initially so designed that drivers could find an interval to manage to go through when a traffic volume was low. The current situation in the city does not allow vehicles in the minor approach to find a proper interval at the non-signalized intersection. As a result minor road traffic forces into any available intervals, although it seems not safe to enter, thus blocking traffic flow on the main roadway. Finally, all traffic at that particular intersection comes to standstill and creates traffic jam on all the legs of the intersection. The solution practiced now is the police officers, who give more green time for congested leg of the intersection.

There are several roundabout intersections in CBD area of the city. The roundabout intersection has the merit of providing continuous circulation of traffic and safe movement of traffic. However, traffic on every leg of the roundabout has to stop or slow down before entering the roundabout, which causes accumulation of queues when the traffic volume is high. Currently due to a large amount of traffic in the downtown Dar es Salaam, every roundabout is a bottleneck of traffic in the city.

At what level of demand might roundabouts be considered inadequate? Roundabout capacity is influenced by both the entry volume for any given approach, and the circulatory volume already within the roundabout. For single lane design, based on FHWA guidelines[5], combined flow should not exceed

[4] Study of Traffic Management on Trunk Roads in Dar Es Salaam Region, by BKS Global Ltd, for TANROADS

[5] *Roundabouts: An Informational Guide*, US Department of Transportation, Federal Highway Administration, Washington DC 2003

1,800 pcu/hr. However, exit flows in excess of 1,200 pcu/hr at a single location suggests a need for double-lane exit at that point. Widening the roundabout to a two lane configuration (both for entry and circulation) roughly doubles system capacity; however, data also suggest that an almost similar system capacity can be achieved by supplying two circulatory lanes, but only flaring the approach from single to double lane (**Figure 6.4.1**). The Dutch and French "rules of thumb" suggest that combined flow for single lane roundabouts should not exceed 1,500 pcu/hr, some 20 percent lower than the FHWA suggestion[6].

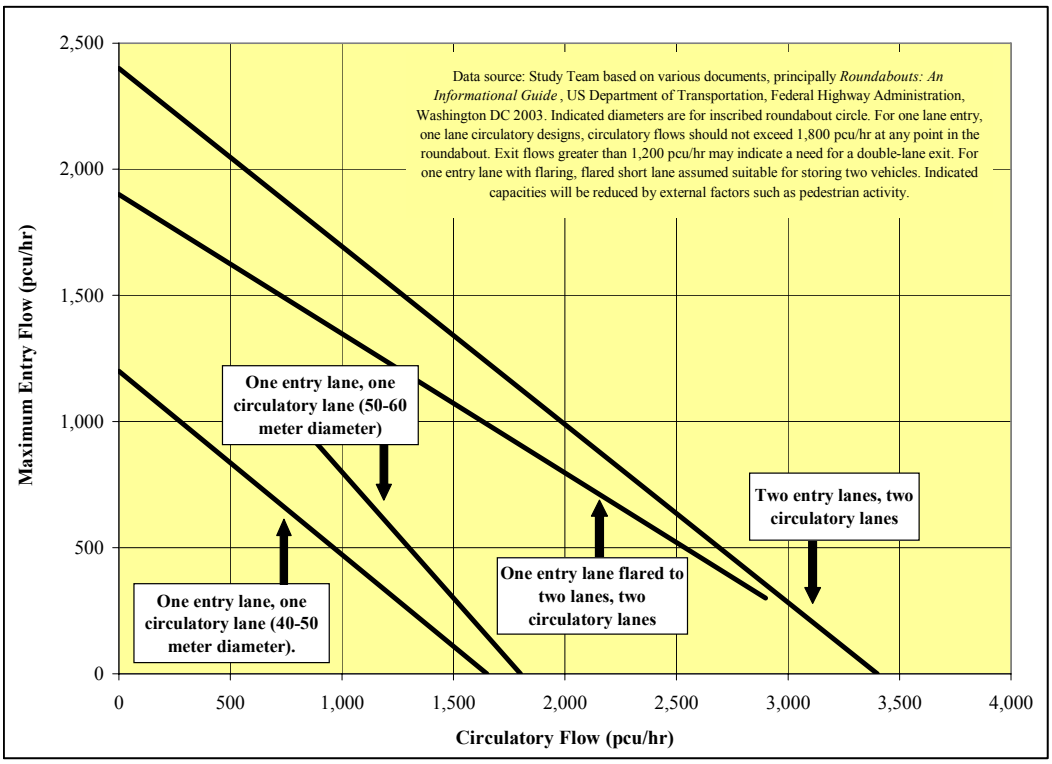



**Figure 6.4.1 Roundabout Capacity Relationships**

In Germany[7], local convention suggests that single-lane roundabouts operate very well in the range of 15,000-25,000 vehicles per day. For double-lane design, the European, North American and Australian experience suggests a maximum daily range of 40,000-60,000 vehicles[8]. Given that non-signalized roundabouts with more than two lanes show only marginal improvement in capacity over those featuring two lanes, it may be concluded that a standard signalized intersection design is, in terms of capacity, more appropriate for volumes higher than those indicated.

These thresholds offer reasonable guidelines for Dar es Salaam. Above indicated volumes, serious consideration should be given to removing any existing roundabout, and replacing with a modern

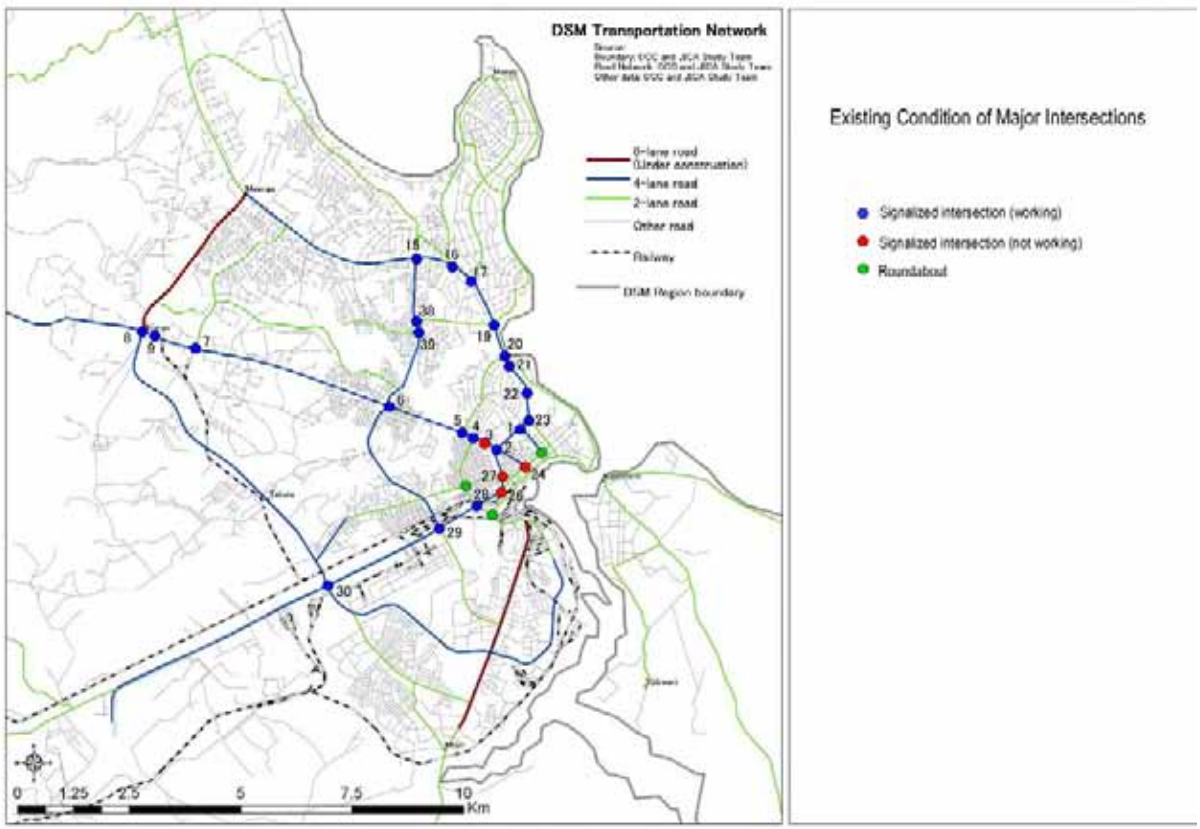
6 *Designing and Operating Safer Roundabouts*, G. Jacquemart, ITE/FHWA Technical Conference on Intersection Safety, 2004

7 *Roundabouts-The State of the Art in Germany,* ITE Journal, November 1998

8 *Roundabouts in Edmonton-A Comparison to the State-of-the Art*; Clayton, Kua and Stephenson, paper presented at the 2004 Annual Conference of the Transportation Association of Canada, Quebec City, Canada.

signal system within a properly designed intersection.

However, unfortunately, even existing signal installations in Dar es Salaam suffer from a variety of ailments. There are 39 major intersections along trunk roads or arterial secondary roads in Dar es Salaam. Out of 39 intersections, 25 intersections at least have traffic signals irrespective of functioning order. Some are working but with some signal light bulbs not operational because there are no spare replacement parts. Fourteen intersections are controlled as priority intersections. The locations, cross roads, type of intersections and controllers are shown in **Figure 6.4.2** and **Table 6.4.1**.




Source: field observation as of 2007 by JICA Study Team

**Figure 6.4.2 Location of Signalized Junctions**

**Table 6.4.1 Trunk Road Intersection Control Inventory**

| Jct | Trunk Rd. | Cross Rd | | Control | Layout | Controller | Status |
|---|---|---|---|---|---|---|---|
| 1 | Bibititi Mohamed Rd. | Maktaba St. | | Signalized | 4-legged | Kyosan | A; a |
| 2 | Morogoro Rd. | Bibititi Mohamed Rd. | | Signalized | 4-legged | Nippon | A; a |
| 3 | Morogoro Rd. | Lumunba St. | | Signalized | T-jct | Nippon | A; b |
| 4 | Morogoro Rd. | Msimbazi St. | | Signalized | 4-legged | Nippon | A; a(1/2 only) |
| 5 | Morogoro Rd. | United Nations Rd. | | Signalized | 4-legged | Nippon | A; a |
| 6 | Morogoro Rd. | Rashid Kawawa Rd. | | Signalized | 4-legged | Kyosan | A; a |
| 7 | Morogoro Rd. | Skekilanngo Rd. | | Signalized | T-jct | Kyosan | A; a |
| 8 | Morogoro Rd. | Nelson Mandera Rd | Sam Nujoma Rd. | Signalized | 4-legged | Kyosan | A; a |
| 9 | Morogoro Rd. | Kibango Bus Terminal Exit | | Signalized | T-jct | Kyosan | A; a |
| 10 | Bagamoyo Rd. | Sam Nujoma Rd. | | Priority | 4-legged | - | |
| 11 | Bagamoyo Rd. | Old Bagamoyo Rd. | | Priority | T-jct | - | |
| 12 | Bagamoyo Rd. | Kunduchi St. | | Priority | T-jct | - | |
| 13 | Bagamoyo Rd. | Factory Access Rd. | | Priority | T-jct | - | |
| 14 | Bagamoyo Rd. | Shekilanngo Rd | | Priority | T-jct | - | |
| 15 | Bagamoyo Rd. | Rashidi Kawawa Rd. | | Signalized | 4-legged | Kyosan | A; a |
| 16 | Ali Hassan Mwinyi Rd. | Old Bagamoyo Rd. | | Signalized | T-jct | Kyosan | A; a |
| 17 | Ali Hassan Mwinyi Rd. | Haile Selassie Rd. | | Signalized | T-jct | Kyosan | A; a |
| 18 | Ali Hassan Mwinyi Rd. | Kaunda Rd. | | Priority | T-jct | - | |
| 19 | Ali Hassan Mwinyi Rd. | Kinondoni Rd. | Kenyatta Dr. | Signalized | 4-legged | Nippon | A; a |
| 20 | Ali Hassan Mwinyi Rd. | United Nations Rd. | | Signalized | T-jct | Nippon | A; a |
| 21 | Ali Hassan Mwinyi Rd. | Ocean Rd. | | Signalized | T-jct | Kyosan | A; a |
| 22 | Ali Hassan Mwinyi Rd. | Ufokoni St. | Nkomo St. | Signalized | 4-legged | Kyosan | A; a |
| 23 | Ali Hassan Mwinyi Rd. | Ohio Rd. | | Signalized | T-jct | Kyosan | A; a |
| 24 | Morogoro Rd. | Samora Av. | | Signalized | 4-legged | Sahara | A; c |
| 25 | Nelson Mandela Rd. | Kilwa Rd. | | Priority | T-jct | - | |
| 26 | Nyerere Rd. | Nkrumah St. | Lumumba St. | Signalized | 4-legged | Siemens | A; c |
| 27 | Nyerere Rd. | Uhuru St. | Lumumba St. | Signalized | 4-legged | Siemens | A; c |
| 28 | Nyerere Rd. | Msimbazi St. | | Signalized | 4-legged | Siemens | A; a |
| 29 | Nyerere Rd. | Rashidi Kawawa Rd. | Chang Ombe Rd. | Signalized | 4-legged | Kyosan | A; a |
| 30 | Nyerere Rd. | Nelson Mandera Rd. | | Signalized | 4-legged | Kyosan | A; a (4-phase) |
| 31 | Nelson Mandera Rd. | Chang Ombe Rd. | Temeke Rd. | Priority | 4-legged | - | |
| 32 | Nelson Mandera Rd. | Kilwa Rd. | | Priority | 4-legged | - | |
| 33 | Kilwa Rd. | Mbagala Rd. | | Priority | T-jct | - | |
| 34 | Kilwa Rd. | Chanika Rd. | | Priority | T-jct | - | |
| 35 | Kilwa Rd. | Mjinwema Rd. | | Priority | 4-legged | - | |
| 36 | Nelson Mandera Rd. | Uhuru St. | | Priority | T-jct | - | |
| 37 | Nelson Mandera Rd. | Tabata St. | | Priority | T-jct | - | |
| 38 | Rashidi Kawawa Rd. | Kinondoni Rd. | | Signalized | 4-legged | | A; a |
| 39 | Rashidi Kawawa Rd. | Mwinyijuma Rd. | | Signalized | T-jct | | A; a |

Status: A: Installed, B: Not installed, a: Working, b: Not working, c: No trace of used
Source: JICA Study Team. Data as of June 2007.

The following issues have been observed:

- Signals of some intersections are not functioning at all;
- Very limited maintenance actions are performed on the traffic signals mainly due to lack of funds, lack of personnel, insufficient knowledge of the various system and so on;

- Shape and type of signals are not consistent, which will cause confusion to drivers;
- Four different traffic signal controllers are currently used in Dar es Salaam i.e. two Japanese controllers, Siemens (German) and Sahara controller, which was locally manufactured;
- Traffic police intervention of traffic control makes congestion worse;
- Lack of sufficient incident management;
- Signals are not coordinated to maintain smooth flow of traffic on trunk roads; and
- Signal timing is not adjusted according to traffic demand (fixed signal timing is used for all day).

### 6.4.2 Traffic Signs and Markings

The behavior of road users depends on the roadway design features, traffic flow characteristics, traffic stream composition and traffic control elements. The general rules and legislation, which contains sufficient amount of information to regulate, warn and guide the traffic, determines desired efficiency and safety of road users. Traffic control devices, such as signs, signals, and markings, regulate, warn and guide the traffic. Thus, traffic control devices form an important part of the road transport infrastructure.

For effective and efficient functioning of traffic control devices, it is important to ensure that the devices used are uniform. To ensure uniformity, there is need for the recognition of legislation, regulation and a manual for traffic control devices as guiding tools for authorities in charge and road users as well. The devices should also be compatible with regional and international standards.

The recognition and realization of above deficiency necessitates the Manual for Uniform Traffic Control Devices to be used within Tanzania. The Manual is approved by the Minister responsible for roads in accordance with Traffic Control Devices Regulations, 2006 under the Road Act No. 30, and is recognized as the national standard for Traffic Control Devices on all public roads. The dissemination of these standards have begun (**Figure 6.4.3**).


**Figure 6.4.3 Tanzanian Uniform Traffic Control Devices**

The traffic control devices are classified into the following classes and sub-classes according to the regulations:

- Traffic signs (regulatory signs; warning signs; guide and informative signs; and additional panels);
- Pavement markings (regulatory markings; warning markings; and guide or informative markings); and,
- Traffic signals (regulatory signals and warning signals).

**Figure 6.4.4 Obsolete *No Entry* Sign**

While such new standards exist, devices installed earlier have been placed on the network with some degree of inconsistency in terms of placement, size, shape and color. An obsolete no-entry sign still in use is depicted in **Figure 6.4.4**, while a modern legal sign is shown in **Figure 6.4.5**. There is a pressing need to rectify this situation either as a part of on-going maintenance, or a comprehensive review program.


**Figure 6.4.5 Mandated *No Entry* Sign**

The condition (quality of maintenance) of in-place devices and markings is an area of concern. A road marking survey[9] was undertaken during 2003 to determine if the required road markings are provided and if their condition was acceptable. The conclusions are that very few of the intersections comply with the then-existing recommended standards given in the Southern African Development Community, Traffic Signs Manual. The substandard elements involve:

- Lack of stop lines;
- Lack of lane markings;
- Lack of white and yellow arrows on road surface;
- Lack of road signage providing information to motorists.
- Layout of the road signage.

In the few isolated cases where the road marking comply to the required standards, but in general the condition of the road markings were found to be poor and/or in need of (re)application (**Table 6.4.2**).

[9] *Study of Traffic Management on Trunk Roads in Dar Es Salaam Region*, op. cit.

**Table 6.4.2 Major Findings of Road Marking Survey**

| Jct No | Trunk Rd | Cross Rd | Road Marking Acceptable | Road Marking in Poor Condition | No Road Markings |
|---|---|---|---|---|---|
| 1 | Bibititi Mohamed Rd | Maktaba Street | √ | | |
| 2 | Morogoro (A7) Road | Bibititi Mohamed Rd | √ | | |
| 3 | Morogoro (A7) Road | Lumumba Street | √ | | |
| 4 | Morogoro (A7) Road | Msimbazi Street | | | √ |
| 5 | Morogoro (A7) Road | United Nations Road | | | √ |
| 6 | Morogoro (A7) Road | Rashidi Kawawa Road | | √ | |
| 7 | Morogoro (A7) Road | Shekilango Road | | | √ |
| 8 | Morogoro (A7) Road | Nelson Mandela Road | | | √ |
| 9 | Morogoro (A7) Road | Ubungo Dala Dala Bus Terminal Western Exit | | | √ |
| 10 | Bagamoyo Road | Sam Nujoma Road | | √ | |
| 11 | Bagamoyo Road | Old Bagamoyo Road | | √ | |
| 12 | Bagamoyo Road | Kunduchi Street | | √ | |
| 13 | Bagamoyo Road | Twiga Cement Factory Access Road | | | √ |
| 14 | Bagamoyo Road | Shekilango Road | | √ | |
| 15 | Bagamoyo Road | Rashidi Kawawa Road | √ | | |
| 16 | Ali Hassan Mwinyi Road | Old Bagamoyo Road | √ | | |
| 17 | Ali Hassan Mwinyi Road | Haile Selassie Road | √ | | |
| 18 | Ali Hassan Mwinyi Road | Kaunda Road | | √ | |
| 19 | Ali Hassan Mwinyi Road | Kinondoni Road | | | √ |
| 20 | Ali Hassan Mwinyi Road | United Nations Road | | | √ |
| 21 | Ali Hassan Mwinyi Road | Ocean Road | √ | | |
| 22 | Ali Hassan Mwinyi Road | Ocean Road Hospital (Ufukoni Street) | | | √ |
| 23 | Ali Hassan Mwinyi Road | Ohio Street | | | √ |
| 24 | Morogoro (A7) Road | Samora Avenue | √ | | |
| 25 | Bandari | Kilwa Road | | √ | |
| 26 | Nyerere Road | Nkrumah Street | √ | | |
| 27 | Nyerere Road | Uhuru | √ | | |
| 28 | Nyerere Road | Msimbazi Street | | | √ |
| 29 | Nyerere Road | Rashidi Kawawa Road | √ | | |
| 30 | Nyerere Road | Nelson Mandela Road | | | √ |
| 31 | Nelson Mandela Road | Chang Ombe Road | | | √ |
| 32 | Nelson Mandela Road | Kilwa Road | | | √ |
| 33 | Kilwa Road | Mbagala Road | | | √ |
| 34 | Kilwa Road | Chanika Road | | | √ |
| 35 | Kilwa Road | Mjinwema | | | √ |
| 36 | Nelson Mandela Road | Uhuru Street | | | √ |
| 37 | Nelson Mandela Road | Tabata Street | | | √ |

Source: Study of Traffic Management on Trunk Roads in Dar Es Salaam Region, op. cit.

Non-existent or worn road markings, especially crosswalk markings, remain a problem at present, and continue to potentially contribute to accidents involving pedestrians (**Figure 6.4.6**). Operation and maintenance of traffic control and safety facilities on trunk roads such as signs and markings is under TANROADS management. It seems difficult to fulfill all the requirements in a short period due to budget constraint and lack of staff. Dar es Salaam City Council is in charge of installation in the city streets. However, most of city streets are not equipped with such signs and markings, which cause confusion to drivers and interrupts smooth flow of traffic.

**Figure 6.4.6 Worn Crosswalk Markings**

### 6.4.3 Geometric Design of Roads and Streets

The most influential elements of planning and design of roads related to traffic control and management would be the number of lanes in a corridor. The number of lanes and configuration of roads govern the actual capability of roads to handle demands. The estimated traffic volume of a specific road in the target year determines the number of lanes.

Currently most arterial roads in Dar es Salaam are at most two lanes for each direction and majority are two lanes for both directions with a nominal lane width of 3.0 – 3.5 meters and a shoulder with which is usually undefined. The maximum capacity of this type of roads under ideal conditions is 2,000 to 2,500 pcu/lane/h without interruption and with full shoulder. The actual capacity of traffic volume depends on vehicle mix, roadside friction, lane width and alignment of roads. If traffic control and other interruptions exist, the maximum capacity of interrupted flow would drop to 600 to 800 hourly vehicles/lane or less. The average hourly demand on these roadways is likely to be 1,500 – 2,000 vehicles (being predominantly automobiles during morning and evening peak periods); volume considerably exceeds available capacity resulting in a substandard level of service.

The basic framework of existing road network was built based on the number of traffic, which was far less than the present value. Additional stretches were constructed and widening of some sections were made. However, these improvements are far behind the ever-growing population and traffic demand increase during 30-year periods.

There are some sections where the capacity of roads during peak hour periods seems less than the demand though the signal control or priority control is properly done. These are:

- Ali Hassan Mwinyi Road (from Ocean Road intersection to Kinondoni Road), which include the Selander Bridge;
- New Bagamoyo Road (from Rashidi Kawawa Road to Sam Nujoma Road), which is two-lane, two-way road;

- Uhuru Street, which is two-lane, two-way road;
- Morogoro Road (from Rashidi Kawawa to Bibititi Mohamed Road);
- Nyerere Road (from Chang Ombe Road to CBD); and
- Kilwa Road near Bandari Road (Kilwa Road is currently under construction).

The issue of intersection sufficiency is addressed in additional detail in Chapter 5, Section 5.1, of this volume.

Some arterial roads in Dar es Salaam urban area are usually multi-lane highway equipped with median, sidewalks, right-turning lane and properly working signals, all of which ensure the smooth flow of traffic. Concentration of traffic to these specific arterial roads happens due to lack of intensive highway network and lack of road hierarchy. There are virtually few alternative routes to avoid traffic congestion on a specific route. Road conditions of secondary roads and local roads, which are normally two-lane two-way roads, are extremely bad.

The existing road capacity in Dar es Salaam as a road network is poorly managed and this contribute to congestion substantially. As mentioned earlier, mal-functioning traffic signals, poor setting of signal timing, and no coordination of signals along the arterial highways worsen this condition. Other factors influence the capacity of roads. They are:

- Poor road environment; this includes narrow shoulder where break down vehicles can park in case of emergency, poor sight distance due to obstruction in the right of way and vendors alongside of roads.
- Lack of parking facilities especially in CBD.
- Inadequate or lack of bus stops and bus facilities, which give a chance for Dala Dala buses stop on the carriageway. This brings all traffic behind stopping and making long queue. Many main roads do not have properly designed bus bays, where buses stop to pick up and drop passengers without interrupting vehicles on the travel lane.
- Intersection designs do not consider high volume of a specific turning movement. In such intersections, the number of turning lanes may be more than one.

### 6.4.4 One-way Streets

Configuration of city streets determines the use of automobiles in the road network. Some streets can handle large volumes of traffic, whereas some streets mainly cater for access purpose including moving pedestrians, loading and unloading of cargos, parking or street trading. Such street type must be considered in the CBD area redevelopment. Currently, it can be possible to differentiate two types of roads and usage in Dar es Salaam city area (also refer Chapter 2 this volume for a discussion of road functional classification):

- Main facilities - Bibiti Mohammed, Morogoro, Uhuru/Railway, Samora, Sokoine, Kivukoni Front, Azikiwe, Ohio and Ocean Roads
- Supporting facilities - Libya, Kisutu, Jamhuri, India, Indra Gandhi, Zanaki, Garden and Ghana.

Although main roads exist for circulation purpose, narrow roads and streets dominate the CBD and similar areas because they were planned during the colonial period, when the traffic volume was far smaller than at present. The narrowness of the roads necessitated the city government to plan and provide one-way streets. Current one-way system in CBD Dar es Salaam is shown in **Figure 6.4.7**.


Source: field observation as of 2007 by JICA Study Team

**Figure 6.4.7 Central Business District One-way Street System**

The purpose of one-way system was to create more space for traffic of a specific direction thus ensuring smooth traffic flow, instead of simply providing two-lane two-way street. Nevertheless, illegal parking vehicles occupy such space thus hindering effective use of space and smooth flow of traffic. This is because signs are not clearly shown, there is no edge and lane markings indicating traffic lanes of two lanes on such road as Samora Avenue, and there is no stop line at the intersection indicating where to stop at the intersection. Another type of one-lane, one-way street is to create more spaces for loading and unloading of cargos or parking spaces without interrupting traffic flow, such as India Street.

There are no evident through streets in the city with exception of multilane streets such as Bibititi Mohammed Road and Maktaba Street, which could handle a large volume of traffic. Unless the priority

signs are posted at each intersection of through streets, all vehicles stop or slow down at every intersection to avoid collision. Slow down and stops obviously interrupt smooth traffic flow. Samora Avenue, again, is currently operated as two-lane one-way street to handle a large volume of vehicles but the parking spaces along the street spoil the nature of through street.

### 6.4.5 Police Control of Traffic

Police control of intersections are generally practiced in roads and streets in Dar es Salaam especially where the intersections are either not equipped with traffic signals; traffic signals are malfunctioning or during morning and evening peak hour periods when the traffic on a specific leg or direction is overwhelming (**Figure 6.4.8**). Police control of traffic is limited as they judge priorities based on their own experience and generally will prioritize safety over congestion issues. A police officer applying 4-phase control system, can reduce the capacity of intersection.

**Figure 6.4.8 Manual Police Control at Intersections**

### 6.4.6 Traffic Control of Arterial Roads with BRT System

The first phase of BRT line along Morogoro Road from Kimara Terminal to Kivukoni Terminal (via Sokoine Drive and Kivukoni Front) with an extension to Morocco Terminal and Kariakoo (via Msimbazi Street) will feature BRT stations placed every 500-700 m with 'at grade' pedestrian crossings to the median BRT station. Heavy vehicles will not be allowed in the section east of the Ubungo intersection changing the road use into a more 'urban use' configuration. This will reduce the smooth flow of traffic on this arterial corridor in vavour of a public transport alternative: the BRT system.

Chapter 5 Section 5.2 discusses the issue of signal phasing (limiting the turning of general traffic across the busway) with various traffic management options presented as well as a BRT management option to ensure that traffic management is improved. The present phase 1 BRT plan of disallowing right turns across the BRT is severely problematic and will cause serious traffic disruption especially at Ubungo intersection where large vehicles are planned to use u-turn facilities on the crossing road, which also has a large volume of traffic. Some other intersections have the similar problems. What

will happen when right turning is not allowed at Morogoro Road and Bibititi Mohamed Road intersection? All the traffic going to CBD area from Morogoro Road would use Bibititi Mohamed Road first and then turn right either at Maktaba Street or at Ohio Street intersections, which interrupt traffic on already congested Ali Hassan Mwinyi Road. Therefore, careful examination of changes of traffic patterns will be necessary before start of BRT system construction. The results might necessitate increasing the supply of right turning opportunity at both intersections via dual turning lanes.

### 6.4.7 Tidal Flow Traffic Management

Tidal flow management technique has been implemented on Al Hassan Mwinyi Road (and Bagamoyo Road) and Morogoro Road during morning and evening peak periods in order to increase the capacity of roads of prevailing direction by shifting the centerline of roads to increase the number of lanes to three in each peak period (**Figures 6.4.9** and **6.4.10**). This is one of the ways to make full use of existing road facilities. Vehicles can use either one of the three lanes toward CBD in the morning and toward suburbs in the evening. The idea itself sounds effective, however, it seems that the actual effect is rather below the expectation.

**Figure 6.4.9 Tidal Flow Arrangement Ali Hassan Mwinyi Road at Ocean Road**

**Figure 6.4.10 Tidal Flow Signage Selander Bridge**

Some problems related to the configurations and operation are:

- Start and end point of the management is not clearly shown to drivers;
- Although time is clearly indicated on the sign board, drivers simply neglect time at the beginning of management;
- Passing vehicles on the minority lane may cause head-on collisions with on-coming vehicles ;
- Right turning vehicles from the minority lane must cross the prevailing lane, which may increase possibility of head-on collision;
- Drivers of median side lane of the prevailing direction need to alert to a possible coming vehicles; and
- Police intervention seems less to maintain safety.

Post evaluation of this management will be necessary after a certain period of practice.

### 6.4.8 Traffic Demand Management

One of the policy instruments of traffic control and management is traffic demand management (TDM). The purpose of TDM is to reduce automobile use so that any type of transportation mode can effectively use the present supply of road facilities. Although more than 90% of passenger movements in Dar es Salaam depend on the public transport system, which consists mainly of Dala Dala bus services, conceivable TDM measures includes;

- Encourage more use of mass transportation system through the service of, such as,:
  a) Bus Rapid Transit, with new articulated bus fleets of higher capacity, reliable services and safe transportation to attract more people to use bus transportation,
  b) Trunk bus service on non-busway roads, and typically operating in mixed traffic, which supplements and complements BRT services.
  c) Zone bus service, which serves in a specific zone,
  d) Bus service for handicapped people,
  e) Shuttle bus service between high activity precincts/developments,
  f) Circulatory bus service within the CBD, thus promoting public transportation use in the high activity core area, and,
  g) Park and ride facilities, which encourages modal shift from automobile use to mass public transportation (BRT)

- Encourage use of bicycles and pedestrian traffic by:
  a) Pedestrian mall in commercial and business districts,
  b) Pedestrian zone in CBD,
  c) Bike lanes to encourage use of non-motorized transportation modes.
  d) High density development in an urban area.

- Control car ownership by,
  a) Car sharing; this reduces the number of registered automobiles,
  b) Automobile tax increase, which slows down the increase rate of car ownership,
  c) Strict regulation of automobile storage especially in CBD area.

- Restrain automobile use and promoting effective use of automobiles by,
  a) One-way system to maintain smooth traffic flow,
  b) Traffic control zone, which allows only accepted vehicles,
  c) Road pricing to limit the number of vehicles, such as allowing only high occupancy vehicles,
  d) Parking management (regulation),
  e) Car pooling; this aims to reduce commuting traffic during peak periods,
  f) Limitation of vehicles entering into CBD by providing detours.

Currently there is virtually no traffic demand management practiced in Dar es Salaam urban area. In addition to the quantitative gap between traffic demand and available capacity of whole road network system in the city, the present condition of traffic congestion is due to lack of traffic control and transportation management.

TDM is seen as a flexible "toolbox"; many solutions are possible. In the Dar es Salaam context, it is noted that solutions which are appropriate today may not to totally relevant in future (the Master Plan planning horizon extends to year 2030) and vice versa. Linked conditions also exist. Area pricing, while frequently quoted as a possible solution, operates successfully in only a few cities, Singapore and London among them. One of the core requirements of any form of car restraint is that alternative modes of transport are available to absorb restrained demand (lest the restricted area suffer economic damages via a forced suppression of trips). Both London and Singapore possess excellent public transport systems, whose capacity and diversity is sufficient to cater to those motorists choosing not to enter the cordoned restraint area with private vehicles. Other prerequisites also exist, among them political will (restraining any form of car use is an emotional topic for the higher-income populace), reliable technology as well as on-going and honest enforcement.

It is nevertheless of interest to examine, from an empirical point of view, what might be local monetary thresholds for two forms of TSM: voluntary modal choice (switch from car to BRT) and forced modal choice (car restraint via area pricing).

Car users' attitudes were queried at two off-street CBD parking facilities: the Dar es Salaam City Council lot and at Mnaji Moja (near the Usirika Building). Most parking spaces in both the DCC and Mnaji Moja facilities are reserved for the employees nearby the office buildings[10]. The interview questions focused on personal attributes, travel time, travel cost, frequency of bus use, reasons for using cars for commuting, and stated preference for BRT and "Area Pricing" scheme.

The results of time and costs are shown in **Table 6.4.3**.

**Table 6.4.3 Respondent Travel Time and Costs by Mode of Transport**

| Mode of Transport | Travel Time per Trip (min) | Waiting Time (min) | Total Travel Time (min) | Fare/cost per Trip (Tshs) |
|---|---|---|---|---|
| Car | 59.8 | - | 59.8 | 5,551 |
| Dala Dala* | 77.2(56.7**) | 34.9 | 112.1 | 324 |

* The above figures of Dala Dala are referred from the Bus Passenger Opinion Survey, conducted by JICA Study Team.
** The figure shows travel time by Dala Dala, which excludes access/egress time.

Source: JICA Study Team

Most car users consider Dala Dala service less comfortable than the level of service by car they enjoy today. The reasons why they do not use are primarily inconvenient service by Dala Dala (47% of respondents) including long waiting hours at the bus stop and unreliable service (26%). However, 92 % of surveyed car users suggested a possible shift from car to BRT buses once introduced.

[10] Interviews with National Parking System representatives confirm that 100 out of 180 parking spaces are reserved for

The survey further queried the preference and costs for BRT bus use. When the fare remains the same level as the present bus services (on the average 250 Tsh) and BRT operates 40 minutes faster than a car trip, 71 % of car users would shift to BRT. Whereas, if fare is set to be 400 Tsh, irrespective of faster travel time by BRT, only 6 % of car users surveyed would use buses (**Figure 6.4.11**). These results confirm that car users are relatively sensitive about cost rather than time savings; more people use buses when the fare is cheap but when the fare becomes 400 Tsh the preference shifts to car use.

The survey also addressed a combination of BRT (encourage bus use) and area pricing scheme (discourage use of cars). With an area pricing level of 2,000 Tsh, vis-a-vis a 400 Tsh bus fare (800 Tsh for round trip), 94 % of surveyed car users answered that they would shift from car to BRT use. The resultant willingness-to pay model suggests that 15 % reduction in car use can be attained with a 400 Tsh bus fare (800 round trip) and a 1,800 Tsh daily area pricing charge (**Figure 6.4.12**).

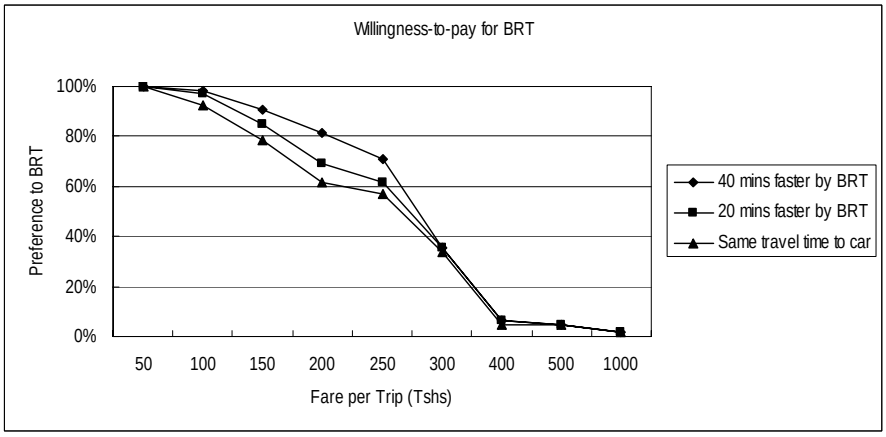



**Figure 6.4.11 Willingness to Pay for BRT**

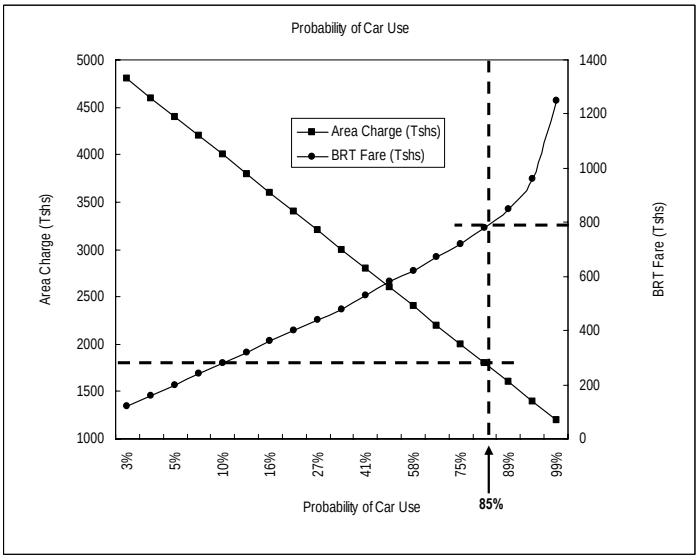



**Figure 6.4.12 Probability of Car Use with Various Area Pricing and Bus Fare Levels**

company employees in the Dar es Salaam City Council facility.

## 6.5 Parking Control and Management

The city government has long been aware of the lack of parking spaces for motor vehicles and has tried to provide paid-parking system since in the 1960's. However, it ceased to function in the early eighties[11] because of poor management, lack of expertise, and substandard facilities. The present management of paid street parking in the CBD of Dar es Salaam started in 1997 following the contract between Dar es Salaam City Commission, as the employer, and Tanzania Parking System Co. Ltd as the contractor.

Every motorist is obliged to pay to Parkman fees/charges for the motor vehicle immediately after parking before leaving the motor vehicle at the parking bay. This fee, which is termed as initial fee, could be for one hour or more hours. The current fee/charge for one our is 300 Tsh. However, where a vehicle parked in a parking bay without paying for the initial parking fee, or continued to remain in the parking bay beyond the period paid for, the Parkman may clamp and immobilize the vehicle until such time the initial and or excess fees are paid.

Lack of parking space in the city especially off-street parking requires motor vehicles parking on the street parking facilities designated by the Dar es Salaam City as noted earlier. Parking maneuver, especially parking to right angle parking lots, hinders the through traffic thus reducing the capacity of streets in the CBD. This not only interrupts smooth flow of automobile traffic but also reduce spaces for pedestrians and non-motor vehicle transportation. Pedestrians are obliged to walk on the street, which also cause disturbance to traffic and increase possibility of being involved in the accidents.

It is understood that the parking contractor complained motor vehicles parked in "NO PARKING" areas because this decrease the contractor's revenue that would have been collected if such motor vehicles had parked in the authorized slots. It appears the contractor does not get the required cooperation from his employer or from police. Besides, parking vehicles on the "NO PARKING" zone, which is usually designated due to hazardous locations, often interrupt through traffic on the street.

It was previously pointed out that[12]:

- The formal parking lots are few in the Central Area and were privately owned. These lots were scattered throughout the Central Area. There were lots that were vacant land, not paved and provided no layout of parking spaces. Therefore, these facilities were not used for their potential capacity; and
- Nearly all curb parking spaces were heavily utilized and there were many vehicles illegally at curb locations throughout the day. It attributed these conditions of lack of time restrictions on curb parking and lack of sufficient resources to regulate illegal parking.

JICA conducted a survey in 1993 aimed at, among other objectives, identifying problems hindering the

[11] *Review Report on the Paid Street-Parking System in the City of Dar Es Salaam*, prepared by a Committee appointed by the Dar es Salaam City Commission, May 2000

[12] *Dar Es Salaam Urban Passenger Transport Study,* for The Government of the United Republic of Tanzania, by Wilbur Smith Associates, Final Report, July 1991.

development of the city. The Study included a car parking facility survey, which was conducted for three days for the surveyed area within the city. These were:

- Car parking survey at one time; the number of cars parked on a given road in the central area, at one given time, was counted by vehicle types.
- 12 hour car parking survey; the number of cars parked along Samoa Avenue was counted for 12 hours by vehicle type.
- Car parking time survey; license plate number was recorded every 15 minute.
- Car parking facility survey; Location and condition of parking facilities in the city center was surveyed.

The study pointed out problems as listed below;

- The shortage of parking spaces forced a large number of vehicles park on roadsides, which lower the road capacity to a great extend;
- Roadside parking was becoming a major cause of intrusion of pedestrians into carriageways thus increasing accidents and lowering driving speed;
- According to the parking survey, potential parking demand in this area was estimated about 30,000 a day, whereas the number of authorized parking lots was as small as 2,000 including curb parking lots;
- Parked vehicles on a certain stretch of the road reduce its effective width and consequently its capacity; and
- Vehicles looking for available parking spaces increase unnecessary traffic circulation and sometimes cause accidents.

Another survey[13] on current use of parking was conducted in September 2005 in order to asses the availability of parking, and determine the impacts of DART construction. The survey methodology was as follows:

- Surveyors counted the number of legal parking spaces on each street and each parking garage within the city center, including Kariakoo and Kivukono;
- The surveyors counted the number of cars parked on each street and in each parking garage on three different weekdays. All parked cars were counted, whether legally or illegally parked;
- The surveyors recorded the cost of parking and any restrictions such as reserved parking for a particular business owner; and
- Surveys took place on weekdays between 10 am and 3 pm.

The following conclusions were drawn from the survey results (**Tables 6.5.1**, **6.5.2** and **6.5.3**):

[13] *Parking Management, Bus Rapid Transit for Dar es Salaam*, Nelson/Nygaard Consulting Associates April 2006

**Table 6.5.1 Summary of Parking Survey Results (All Spaces)**

| | Kariakoo | CBD South | CBD North | Kivukoni | Total |
|---|---|---|---|---|---|
| Parking spaces | 5,260 | 1,728 | 4,261 | 2,554 | 13,803 |
| Parked cars | 3,714 | 1,585 | 3,358 | 1,937 | 10,594 |
| Occupancy | 71% | 92% | 79% | 76% | 77% |

Source: Parking Management, Bus Rapid Transit for Dar es Salaam, Nelson/Nygaard Consulting Associates April 2006

**Table 6.5.2 Summary of Parking Survey Results (On-street Spaces)**

| | Kariakoo | CBD South | CBD North | Kivukoni | Total |
|---|---|---|---|---|---|
| Parking spaces | 5,130 | 1,231 | 2,693 | 1,502 | 10,556 |
| Parked cars | 3,634 | 1,251 | 2,021 | 1,074 | 7,980 |
| Occupancy | 71% | 102% | 75% | 72% | 76% |

Source: Ibid.

**Table 6.5.3 Summary of Parking Survey Results (Off-street Spaces)**

| | Kariakoo | CBD South | CBD North | Kivukoni | Total |
|---|---|---|---|---|---|
| Parking spaces | 130 | 497 | 1,568 | 1,052 | 3,247 |
| Parked cars | 80 | 334 | 1,337 | 863 | 2,614 |
| Occupancy | 62% | 67% | 85% | 82% | 81% |

Source: Ibid.

- There is no shortage of parking in central Dar es Salaam- Only 77% of legal parking spaces are used on a typical weekday. For comparison, 85-90% is generally considered the optimum balance between efficiency and ease of finding a space;
- Ample parking will be available, even following DART construction;
- It can be difficult to find a parking space in many central areas.- While there is no shortage of parking overall, there are many "hot spots", particularly in the south of the CBD, where parking is fully occupied;
- Off-street parking is underutilized.- Even in the south of the CBD, where on-street parking is at a premium, there are numerous empty spaces in garages;
- Reserved parking means that not all spaces are available. 20% of spaces that were counted as "unoccupied" during the surveys were reserved for a specific business, meaning they were unavailable to the general public; and
- The City is not realizing the full revenue potential from parking.

The key conclusions from the study are as follows:

- Paid parking was introduced in the city center in the late 1990s at a rate of 300 Tsh per hour in the core area. Revenue collection is contracted out to Nation Parking Solutions (NPS), with the

City Council entitled to 75% of the revenue. However, the City Council does not appear to receiving the maximum potential revenue.

- Off-street parking has been built as part of many new developments, as required under Ministry of Land's policy. The cost per space in recent large developments has ranged between US$ 3,000 and US$ 4,150. This indicates an hourly parking charge of 175 – 250 Tsh would be required to cover construction costs alone without considering operation and land costs. Therefore, at current rates, new off-street parking would be unlikely to be financially feasible without subsidy.
- There is a large supply of available parking in the City center. More than 13,800 spaces exist on-street and in garages, and only 77% are occupied by parked cars.
- It can be difficult to find on-street parking in central areas, despite the overall abundance. This is due to two main reasons: (i) underutilization of garages such as JM Mall, even in areas where on-street parking is fully occupied; and (ii) reserved on-street parking spaces, which reduce the number of available spaces to the public.

Three types of curb parking arrangements are typically used in Dar es Salaam. These are right angle (90 degrees) bays, 45 or 60 degree angle bays, and parallel bays. Angled parking spaces are generally located along wide streets with less traffic. Parallel parking spaces tend to be provided along narrow or busy streets. Angled space ingress/egress maneuvers can completely block through traffic, while concurrently posing accident concerns (particularly while backing out of parking spaces). While providing for storage needs of vehicles, it is concurrently accepted that curb parking directly impacts traffic operations (**Figure 6.5.1**). In some instances curb parking absorbs carriageway width intended for traffic movement. For example, Azikive Road (Maktab Road near Bibititi Mohamed Road) features an intended four-lane, median separated cross-section and is expected to accommodate heavy traffic volumes to/from the CBD. However, observations confirm that only one directional lane is available for traffic, with remaining road surface being used for right angel parking. At this location traffic is also blocked by stopped, or double stopped, Dala Dalas in front of the Central Post Office, even though bus stops and bus bays are provided (**Figure 6.5.2**).

**Figure 6.5.1 Impacts of Parking Activity on Traffic Flow**

When BRT is introduced in the city, it will be necessary to promote efficient use of street facility. The way to efficient use may include ban of on-street parking spaces depending on the area and land use characteristics of CBD. It is clear that parking maneuvers interrupts smooth flow of traffic of arterial streets, in which traffic flow should be smooth. On-street parking would be allowed along the street of which main role is accessibility or commercial activities.

**Figure 6.5.2 Dala Dalas Blocking Traffic Lanes**

## 6.6 Road Safety

Road accident losses to society in terms of deaths, injuries and property damage can be pronounced. Apart from the humanitarian aspect of reducing road deaths and injuries, a strong case can be made for reducing road crash deaths on economic grounds alone, as they consume massive resources that countries can ill afford to lose. It must, of course, be concurrently noted that in many nations, road safety is but one of the many problems demanding its share of funding and other resources. The economic cost of road crashes is substantial. In the United States, 1994 vehicle crashes consumed $150.5 billion, or between 2-3% of the country's GDP[14]. In other parts of the world, economic loss as a function of GNP generally hovers in the 1-2% range, but can reach up to 4-5%. The Tanzanian experience has been at some 1.3% of GNP (**Table 6.6.1**).

A broader review of traffic accidents in Sub-Saharan Africa[15] came to similar conclusions; that is, the impact of road accidents will range from 1-2% of GNP. This implies, based on year 2000 conditions, a net loss of 3.1 to 6.2 billion US$. The study accurately concludes that "….Clearly, these are sums of money that the nations of Africa can ill-afford to lose every year".

On a global basis, estimates of the annual number of road deaths vary, as a result of the limitations of injury data collection and analysis, problems of underreporting and differences in interpretation. The estimates range from around 750,000 (probably an underestimate, since it is made on the basis of 1998 data) to some 1.18 million annually – representing over 3,000 lives lost daily. Around 85% of all global road deaths, 90% of the disability-adjusted life years lost due to crashes, and 96% of all children killed worldwide as a result of road traffic injuries occur in low-income and middle-income countries. Over 50% of deaths are among young adults in the age range of 15–44 years. Among both children aged 5–14 years, and young people aged 15–29 years, road traffic injuries are the second-leading cause of death worldwide[16].

[14] The Economic Cost of Motor Vehicle Crashes, 1994; by National Highway Traffic Safety Administration, Washington DC, USA, 1997.
[15] *Africa Road Safety Review*, G. Jacobs and A. Aeron-Thomas, Transport and Road Research Laboratory, for the US Department of Transportation, Federal Highway Administration, 2002.
[16] *World Report on Road Traffic Injury Prevention*, World Health Organization, Geneva, 2004.

**Table 6.6.1 Recent Estimates of Economic Costs of Road Crashes**

| Global Region | Nation | Absolute Value (Mill 1997 US$) | Relative Value (Percent of GNP) |
|---|---|---|---|
| Latin America | Brazil | 15,681 | 2.0 |
| Asia | Vietnam | 72 | 0.3 |
| | Bangladesh | 220 | 0.5 |
| | Thailand | 3,810 | 2.3 |
| | Rep. Korea | 12,561 | 2.6 |
| | Nepal | 24 | 0.5 |
| | Indonesia | 691-958 | - |
| Africa | KwaZulu Natal | - | 4.5 |
| | **Tanzania** | **86** | **1.3** |
| | Zambia | 189 | 2.3 |
| | Malawi | 106 | < 5.0 |
| MENA | Egypt | 577 | 0.8 |
| Europe | UK | 28,856 | 2.1 |
| | Sweden | 6,261 | 2.7 |
| | Norway | 3,656 | 2.3 |
| | Iceland | 7,175 | 3-4 |
| | Germany | 30,173 | 1.3 |
| | Denmark | 2,028 | 1.1 |
| Oceania | New Zealand | 2,441 | 4.1 |

Source: Various sources, as quoted in *Estimating Global Road Fatalities*; op. cit.

Yet, with exception of those nations having sophisticated reporting systems, comprehensive and reliable accident data are often lacking. Societal pressures also play a role; for example, "property damage only" accidents may not be reported but instead damages settled between involved parties on the spot. The participation of the police may also not be desired in some instances. Thus, generally, only published data involving fatality accidents and, to a lesser extent, injury accidents, can be considered reasonably reliable indicators of road safety. Further, to remove bias, accident data should be correlated with exposure, that is, the degree to which vehicles are being used. Vehicle exposure data are available for only few nations thus again hindering the development of a consistent and comparative road safety data base. For purposes of the current study, an alternative (if less reliable) approach has been adopted which relates accident data (primarily fatalities whose record keeping tends to be much more reliable than that of accidents or injuries) to numbers of registered vehicles.

Over the past two decades, road accident incidence in Tanzania has been increasing for all three recorded categories: number of accidents, number of personal injuries and number of fatalities. Roughly speaking, between 1987 and 2004, incidence has roughly doubled reaching 17,039 accidents, 17,231 injuries and 2,366 fatalities (**Figure 6.6.1**).

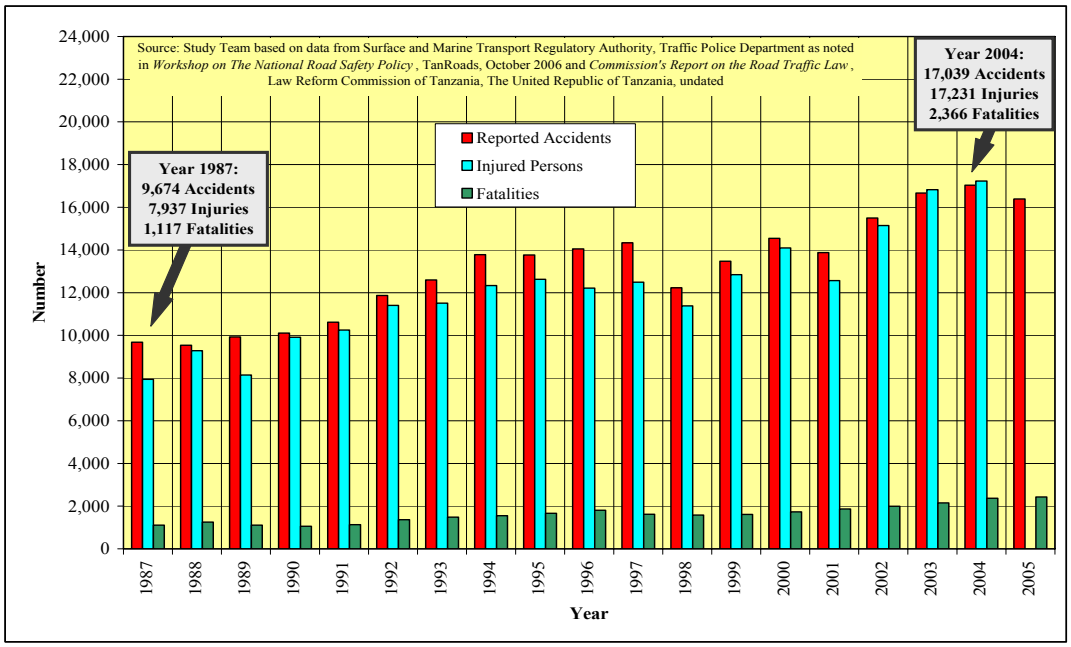



**Figure 6.6.1 Historic Incidence of Tanzanian Road Accidents**

Dar Es Salaam accounts for a significant share of the nations total accident incidence. This share is increasing for all accident categories. During 2001, some 43% of all Tanzanian accidents took place in Dar Es Salaam, as did near 35% of injuries and 20% of fatalities (**Figure 6.6.2**). The implication is that while more accidents happen in the main city, the severity is likely to be less than for accidents occurring in other parts of the nation. One of the contributing factors is no doubt the fact that vehicle speeds tend to be lower in urban than in rural areas.

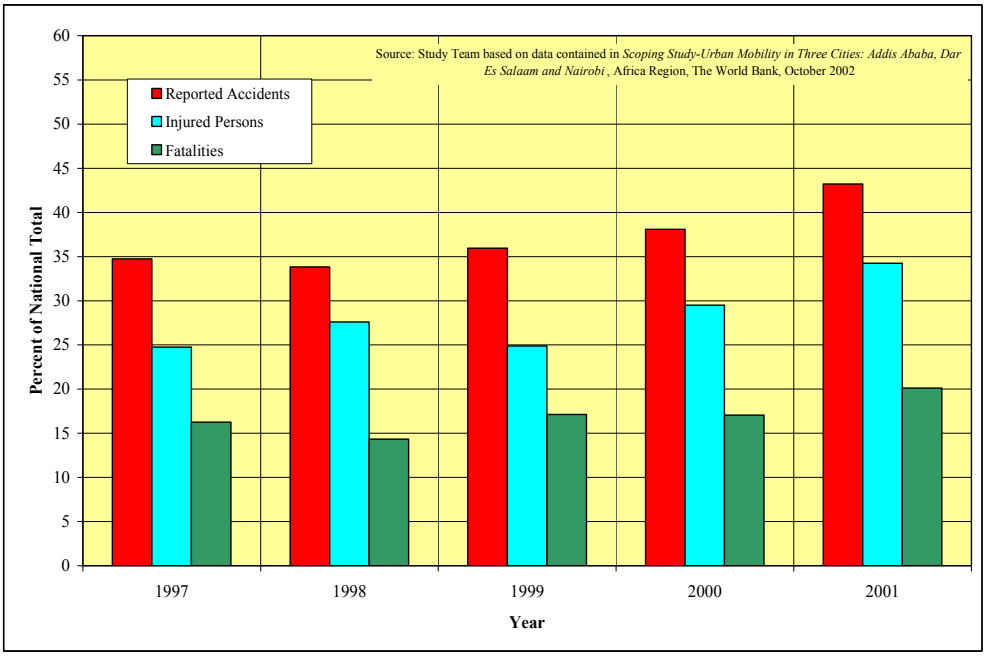



**Figure 6.6.2 Recent Incidence of Dar Es Salaam Road Accidents**

The composition of accident fatalities is most disturbing. For an average of five recent years of record (**Figure 6.6.3**):

- Vehicle passengers, which include bus passengers, were the single largest victim group accounting for 42% of annual deaths.
- Pedestrians were the second largest group, representing near 34% of accidents.
- Drivers, or that proportion of the participants usually noted as being at fault in police records, represented only 11% of average fatalities.

Thus, non-motorized victims of accidents (pedestrians and bicyclists) represent the largest grouping of fatalities (about 42%) to all victims. One may thus easily surmise that this burden is shared unfairly by the urban poor, that is, those persons of insufficient means to afford transport by either car or bus.

The incidence of fatalities in Tanzanian road accidents is worrying. Available data confirm that the national incidence rate (accident fatalities per 1,000 registered vehicles) is indeed high compared to African norms and expectations. While not among the absolutely highest (for example, those of Central African Republic, Ethiopia, Malawi), the rate has in recent years, converged with Uganda and lies above the experiences of Kenya and, by far, South Africa (**Figure 6.6.4**). As a general observation, the fatality incidence rate of Africa is very high. In comparison, with the exception of transitional countries of the former Soviet Union, the European experience is that fatalities per 1,000 registered vehicles rarely exceed 1.0. For the African countries on record, almost none meet this threshold even for a single year of record.

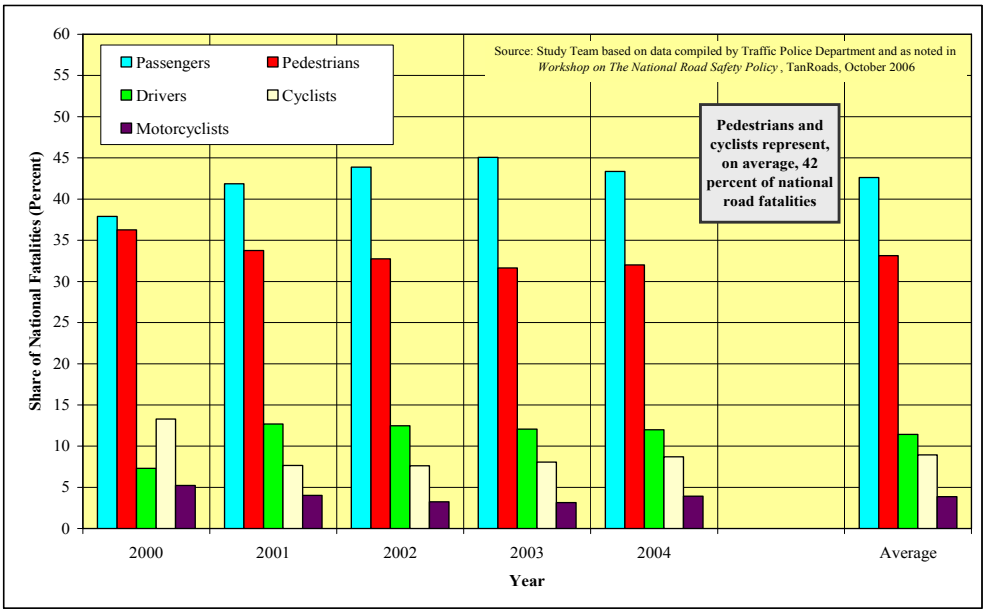



**Figure 6.6.3 Recent Profile of Tanzanian Road Accident Fatalities**

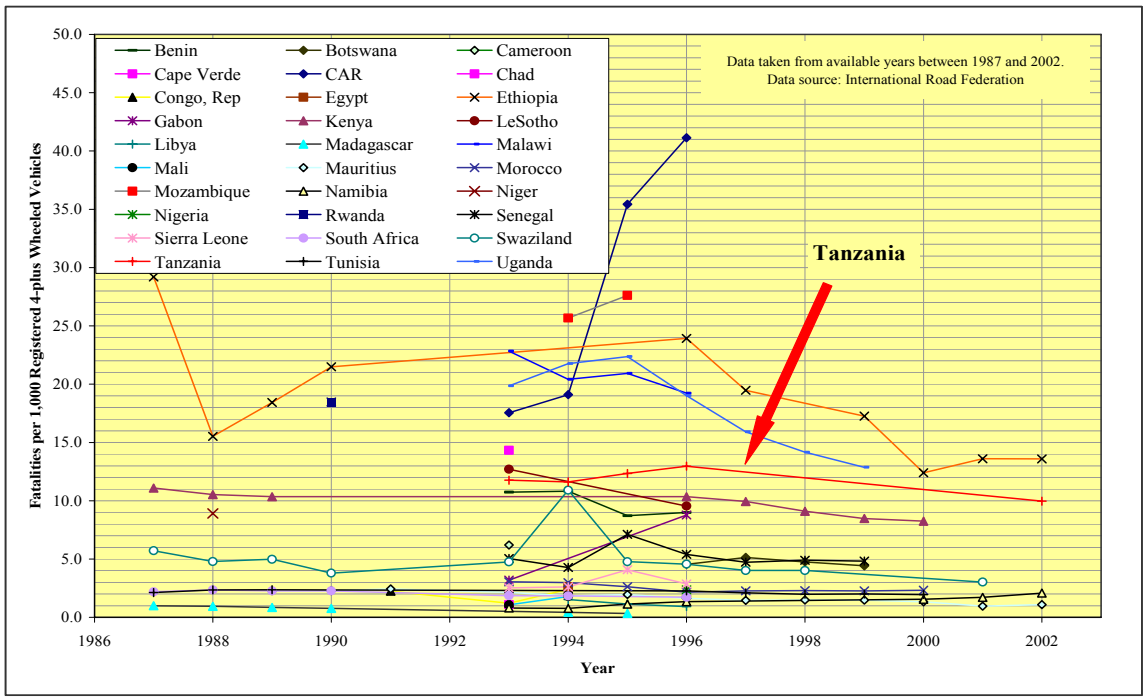



**Figure 6.6.4 Historic Trend in African Road Accident Fatality Rates**

The previously-referenced African road safety analysis[17] examined individual accident rates for available countries based on fatalities per 10,000 registered vehicles and fatalities per 100,000 population. In case of Tanzania, the incidence in terms of vehicle availability, as was the case for the previous figure, places the nation quite high in African terms (**Table 6.6.2**). In East African terms, below Uganda but above Kenya. In terms of incidence based on population, the Tanzanian experience is more moderate given its rather large population base.

[17] *Africa Road Safety Review,* op. cit.

**Table 6.6.2 Recent African Accident Fatality Patterns**

| Country | Fatalties per 10,000 Vehicles | Country | Fatalties per 100,000 Population |
|---|---|---|---|
| Central African Rep | 902 | Botswana | 31.0 |
| Mozambique | 652 | Swaziland | 31.0 |
| Malawi | 245 | South Africa | 19.0 |
| Ethiopia | 199 | Lesotho | 15.0 |
| Rwanda | 161 | Malawi | 12.0 |
| Togo | 132 | Zimbabwe | 11.0 |
| Uganda | 122 | Kenya | 10.0 |
| Ghana | 122 | Zambia | 9.0 |
| Guinea | 121 | Ghana | 9.0 |
| Tanzania | 114 | Nigeria | 9.0 |
| Benin | 90 | Senegal | 9.0 |
| Lesotho | 87 | Uganda | 8.0 |
| Kenya | 73 | Benin | 7.0 |
| Senegal | 66 | Togo | 7.0 |
| Botswana | 55 | Cameroon | 6.0 |
| Cameroon | 52 | Guinea | 6.0 |
| Sierra Leone | 52 | Tanzania | 5.0 |
| Niger | 46 | Congo | 5.0 |
| Swaziland | 46 | Rwanda | 5.0 |
| Nigeria | 45 | Mozambique | 4.0 |
| Zambia | 39 | Cote d'Ivoire | 4.0 |
| Eritrea | 36 | Eritrea | 3.0 |
| Zimbabwe | 34 | Ethiopia | 3.0 |
| Congo | 23 | Gabon | 3.0 |
| Sudan | 20 | Sierra Leone | 3.0 |
| Liberia | 19 | Central African Rep | 2.0 |
| South Africa | 16 | Niger | 2.0 |
| Cote d'Ivoire | 13 | Sudan | 2.0 |
| Gabon | 10 | Namibia | 2.0 |
| Chad | 8 | Liberia | 2.0 |
| Angola | 6 | Madagascar | 1.0 |
| Madagascar | 3 | Chad | 1.0 |

Source: Study Team based on data contained in *Africa Road Safety Review*, op. cit.

## 6.7 Conclusions and Recommendations

The previous discussion gives rise to several conclusions, while concurrently identifying planning issues of relevance to the sector.

It is apparent that significant difficulties exist in the sector, most of which relate to a lack of qualified staff, organizational issues and severe constraints in funding. It is also obvious that no single solution, or no plan/program, taken in isolation will be capable of rectifying identified concerns. It is hoped that the framework of action presented by the Master Plan provides the impetus for change and improvement; unfortunately, the omens are not good. Concerns identified via the current study have also been noted (and recommended upon) by previous studies, most recently the 2003 review of urban roads in Dar es Salaam[18]; yet little has been achieved in the interim.

[18] *Study of Traffic Management on Trunk Roads in Dar Es Salaam Region*, op. cit.

### 6.7.1 Organizational and Institutional Arrangements

The previously-noted parsity of action is, to a large degree and in the opinion of the Study Team, due to a lack of focused approach under the direction of a single controlling entity. At present, numerous stakeholders (TANROADS, DCC, Sumatra, Police, among others), while all well intentioned, tend to pursue programs of different foci, which in turn tend to be dictated by funding and staffing constraints.

**The pressing need to establish DUTA (Dar es Salaam Urban Transport Authority) is obvious.** At the outset it should be clear that the concept of DUTA, as proposed by the Study Team and as detailed in *Technical Report 3*, is not that of a large monolithic Authority doing everything in relation to transport. To the contrary, it is perceived as an efficient coordinating body comprised of major stakeholders through a Board of Management and an efficient executive planning arm that provides strategic guidance, control and planning for the line agencies under the Authority who execute and implement policy.

A potential statement of responsibility that will define the mission of the Authority and its individual Divisions (and in line with the National Transport Policy) is:

- "The design, management and executive control of the urban transport system in Dar es Salaam with the objective of: providing safe, reliable, effective, efficient and fully integrated transport infrastructure; operations that best meet the needs of travel and transport; improved levels of service at lower costs; and supporting government strategies for socio-economic development whilst being economically and environmentally sustainable."

In that perspective, the role of DUTA is clearly specified, acting as intermediate and coordinating Authority between national policy and the agencies responsible management and control of city transport and its development with the obligation to:

- Design the best urban transport system: DUTA will study the functioning of the transport system, identify bottlenecks and problems, and produce concrete solutions for its improvement. These solutions will inform the regulatory and policy decisions made by government and develop into Regulation supported strategic policy to the executing agencies.
- Coordinate all players: DUTA will organize and coordinate all agencies responsible for service delivery by setting objectives-based strategic policy, resources and budget and overseeing at a high level that objectives are being reached.
- Control the urban transport system: DUTA through its strategic coordinating role will work to guarantee the best operational conditions of the urban transport system for both system users and service providers and for those assigned to maintain existing and / or constructing new infrastructures and / or services.

Considering the above role of DUTA, it is thus clear that DUTA is neither an executing agency nor a system operator, but is managing policy, coordination and high level control. It is a local body solely for the purpose of planning and coordinating the affairs urban transport within the boundaries of Dar es Salaam.

### 6.7.2 The Supply of Infrastructure

The causes of traffic congestion are rather complicated with many factors, however, it could be possible to simply present some of those issues in the field of traffic control and management as follows;

- Population increases and urban growth intensifies, thus necessitating that more people undertaking longer distance trips – managing the interaction of land use and transport;
- Residential development in the unplanned areas without proper investment in basic infrastructures including access roads – encourage use of buses by providing better access roads;
- Inefficient use of the existing transportation facilities such as traffic signals – immediate improvement / adjustment of the existing facilities; and
- Poor traffic control and management technique – coordination between the concerned agencies.

However, road network development is still a crucial and very fundamental measures to satisfy the travel demand in Dar es Salaam, including bus passengers, commercial vehicles, and private cars. In the mean time, basic policies to alleviate the present traffic congestion in Dar es Salaam should include some supply side approaches: development of arterial highways that serve transportation of passengers and goods and improvement and expansion of existing road network.

This topic has been addressed in previous chapters of this volume, to include the formulation of mid and longer-term road systems founded upon a functional classification scheme.

Implementation of BRT, and its busway network, as well as supporting bus routes operating on-street, are committed projects. **To reinforce the use of BRT is seen as one of the most promising near-term demand management techniques arising as a direct result of infrastructure provision.**

### 6.7.3 Management of Infrastructure

Traffic control and management measures have not been systematically practiced in Dar es Salaam. While plans, regulations and manuals for traffic control devices exist, only modest progress has, unfortunately, been achieved. The most noted upgrades in traffic control devices, being signals, signs and markings, have been part and parcel of major road upgrading projects. For example, the on-going improvements of Kilwa Road and the Nelson Mandela Road corridor.

Outside of such projects, major findings from field investigations are:

- Major signalized intersections without proper signal control (setting);
- Some traffic signals are not coordinated where it is necessary;
- Many traffic signals are damaged, poorly managed, and not adjusted in accordance with changing traffic volumes;
- Traffic signs and markings do not exist on roads and streets in CBD;
- Traffic control devices are outdated; and,
- Inadequate or lack of bus bays at bus stops for minimizing interruption to smooth flow of traffic.

Firstly the existing traffic signals should be properly adjusted and managed based on the actual demand. For this purpose, a series of traffic count survey will be necessary as soon as possible. Besides, early implementation of the traffic control devices based on the Regulation and Manual is important to remove the bottlenecks along major roads.

A program of proposed intersection improvements focused on signal enhancements is proposed (**Table 6.7.1**).

**Table 6.7.1 Proposed Intersection Improvements**

| Jct No | Trunk Rd. | Cross Rd | Improvement Measures | Status* |
|---|---|---|---|---|
| 1 | Bibititi Mohamed Rd. | Maktaba St. | Double right turn lanes from Bibititi to Maktaba<br>Implement optimal signal setting | A; a |
| 2 | Morogoro Rd. | Bibititi Mohamed Rd. | Signal setting followed by BRT implementation | A; a |
| 3 | Morogoro Rd. | Lumunba St. | Implement optimal signal setting | A; b |
| 4 | Morogoro Rd. | Msimbazi St. | Implement optimal signal setting | A; a(1/2 only) |
| 5 | Morogoro Rd. | United Nations Rd. | Implement optimal signal setting | A; a |
| 6 | Morogoro Rd. | Rashid Kawawa Rd. | Capacity problem during morning peak period.<br>Grade separate structure required. | A; a |
| 7 | Morogoro Rd. | Skekilanngo Rd. | Implement optimal signal setting | A; a |
| 8 | Morogoro Rd. | Nelson Mandera Rd<br>Sam Nujoma Rd. | Capacity problem during morning peak period.<br>Grade separate structure required. | A; a |
| 9 | Morogoro Rd. | Kibango Bus Terminal Exit | Implement optimal signal setting | A; a |
| 10 | Bagamoyo Rd. | Sam Nujoma Rd. | Capacity problems during morning peak period.<br>Install new traffic signal control system for the time being. Grade separation required in the future. | Priority |
| 11 | Bagamoyo Rd. | Old Bagamoyo Rd. | Install new traffic signal system. | Priority |
| 12 | Bagamoyo Rd. | Kunduchi St. | Install new traffic signal system. | Priority |
| 13 | Bagamoyo Rd. | Factory Access Rd. | Install new traffic signal system. | Priority |
| 14 | Bagamoyo Rd. | Shekilanngo Rd | Install new traffic signal system. | Priority |
| 15 | Bagamoyo Rd. | Rashidi Kawawa Rd. | Capacity almost reaches saturation level during morning peak period.<br>Optimum traffic signal and progression are required during morning peak period. Grade separation required in the future. | A; a |
| 16 | Ali Hassan Mwinyi Rd. | Old Bagamoyo Rd. | Optimum traffic signal and progression are required during morning peak period. | A; a |
| 17 | Ali Hassan Mwinyi Rd. | Haile Selassie Rd. | Capacity almost reaches saturation level during morning peak period.<br>Optimum traffic signal setting and progression are required during morning peak period. | A; a |
| 18 | Ali Hassan Mwinyi Rd. | Kaunda Rd. | Install new traffic signal system. | Priority |
| 19 | Ali Hassan Mwinyi Rd. | Kinondoni Rd.<br>Kenyatta Dr. | Optimum traffic signal setting and progression are required during morning peak period. | A; a |
| 20 | Ali Hassan Mwinyi Rd. | United Nations Rd. | Optimum traffic signal setting and progression are required during morning peak period. | A; a |
| 21 | Ali Hassan Mwinyi Rd. | Ocean Rd. | Optimum traffic signal setting and progression are required during morning peak period. | A; a |
| 22 | Ali Hassan Mwinyi Rd. | Ufokoni St.<br>Nkomo St. | Signals should be upgraded.<br>Optimum traffic signal setting and progression are required during morning peak period. | A; a |
| 23 | Ali Hassan Mwinyi Rd. | Ohio Rd. | Implement optimal signal setting | A; a |
| 24 | Morogoro Rd. | Samora Av. | Remove old signal poles and install new signals with optimal settings when BRT is implemented. | A; c |
| 25 | Nelson Mandela Rd. | Kilwa Rd. | Install new traffic signal system. | Priority |
| 26 | Nyerere Rd. | Nkrumah St.<br>Lumumba St. | Replace old unused traffic signals and install new traffic signal system. | A; c |
| 27 | Nyerere Rd. | Uhuru St.<br>Lumumba St. | Replace old unused traffic signals and install new traffic signal system. | A; c |

| Jct No | Trunk Rd. | Cross Rd | Improvement Measures | Status* |
|---|---|---|---|---|
| 28 | Nyerere Rd. | Msimbazi St. | Capacity almost reaches saturation level during morning peak period.<br>Implement optimal signal setting | A; a |
| 29 | Nyerere Rd. | Rashidi Kawawa Rd. | Capacity problem during morning peak period.<br>Grade separate structure required. | A; a |
| | | Chang Ombe Rd. | | |
| 30 | Nyerere Rd. | Nelson Mandera Rd. | Capacity problem during morning peak period.<br>Grade separate structure required. | A; a (4-phase) |
| 31 | Nelson Mandera Rd. | Chang Ombe Rd. | Replace old unused traffic signals and install new traffic signal system. | Priority |
| | | Temeke Rd. | | |
| 32 | Nelson Mandera Rd. | Kilwa Rd. | Install new traffic signal system.<br>Grade separation required in the future. | Priority |
| 33 | Kilwa Rd. | Mbagala Rd. | Install new traffic signal system. | Priority |
| 34 | Kilwa Rd. | Chanika Rd. | Install new traffic signal system. | Priority |
| 35 | Kilwa Rd. | Mjinwema Rd. | Install new traffic signal system. | Priority |
| 36 | Nelson Mandera Rd. | Uhuru St. | Install new traffic signal system. | Priority |
| 37 | Nelson Mandera Rd. | Tabata St. | Install new traffic signal system.<br>Capacity problem may occur in the future. | Priority |
| 38 | Rashidi Kawawa Rd. | Kinondoni Rd. | Implement optimal signal setting | A; a |
| 39 | Rashidi Kawawa Rd. | Mwinyijuma Rd. | Implement optimal signal setting | A; a |

Note: Status as of 2007, A: Installed, B: Not installed, a: Working, b: Not working, c: No trace of used

Source: The JICA Study Team

### 6.7.4 Traffic Control Center

The continuing advent of more and improved signalization implies two tasks lie ahead; firstly, the interconnection of isolated signals into coordinated systems, and, secondly, the realization of a centralized traffic control center. This facility represents the "nerve center" of operational control (**Figures 6.7.1** and **6.7.2**).

**Figure 6.7.1 Control Center**

**Figure 6.7.2 Graphical User Interface**

The traffic control system operated by the Center is composed of:

- Traffic information dissemination system;
- Emergency help and information system;
- Driving safety support system;
- Public transportation priority (BRT) system; and

- Environmental protection management system.

Information collection system is installed along the roadway. There are several types of information collection measures:

- Loop coil detectors embedded in the pavement;
- Ultrasonic detectors;
- ITV traffic monitoring cameras;
- Optical beacon detectors; and
- Information from motorists via mobile telephone or emergency telephone if it is equipped.

All the information such as traffic volume of every 15 minutes or ITV images are transmitted to the Center via optical fiber cable installed along the roads for better control of traffic. The optical fiber has a bigger capacity to transmit sophisticated information such as ITV images, which require more band width.

The information collected is processed and can be displayed via roadside information boards, radio information service, and patrol vehicles (**Figure 6.7.3**). Traffic signals are centrally controlled according to real-time traffic demand. Public transportation (BRT) will be given priority at intersections based on the control system managed by the Center. Parking information can be disseminated if proper parking information is collected.


**Figure 6.7.3 Roadside Information Board**

Incident management is one of the important elements of traffic control. A certain number of traffic congestion and disturbance incidents will invariably be caused by accidents and break downs. Once accidents happen, especially fatal or injury accidents, it is urgent to dispatch ambulance, police and service vehicles. This reporting can be coordinated via the Center to ensure minimum dispatch time.

### 6.7.5 The Need for Grade Separation

The importance of proper intersection operation and effective use of traffic control devices has previously been discussed. However, it is concurrently noted that, at the high-demand intersections, any at-grade solution is likely to be eventually overwhelmed by ever-increasing traffic demand. Intersection-specific investigations, as presented in Chapter 5 of this volume, have identified several candidates for grade separation, with Ubungo and Tazara Intersections being among the highest priority locations.

### 6.7.6 Parking in CBD

Major findings related to parking control and management are as follows:

- Even though off-street parking spaces are available, if the location is not convenient, many motorists prefer parking on-street;
- However, most of the on-street parking spaces are reserved; vacant spaces for ordinary use are scarce;
- The shortage of convenient off-street parking spaces induces motorists to park at the roadside, thus considerably reducing road capacity;
- Roadside parking, particularly with vehicles intruding into footpaths, forces pedestrians to venture into the carriageway, thus increasing the accident potential and lowering driving speed;
- Parked vehicles reduce effective road width and consequently capacity; and
- Motorists circulating through streets searching for available parking spaces increase traffic unnecessarily and sometimes cause accidents.

Parking issues relate mostly to the CBD; and parking management and control strategies are outlined in Chapter 7 of this report.

### 6.7.7 Enforcement

The composition of accident fatalities is most disturbing. For an average of five recent years of record:

- Vehicle passengers, which includes bus passengers, were the single largest victim group accounting for 42% of annual deaths.
- Pedestrians were the second largest group, representing near 34% of accidents.
- Drivers, or that proportion of the participants usually noted as being at fault in police records, represented only 11% of average fatalities.

Thus, non-motorized victims of accidents (pedestrians and bicyclists) represent the largest grouping of fatalities (about 42%) for all victims. A cohesive and integrated approaches to road accident amelioration are needed in Dar es Salaam. The risk factors which underlie accidents complex and numerous, and, in general terms, apply to human, vehicular and environmental factors (**Figure 6.7.4**).

| | | FACTORS | | |
|---|---|---|---|---|
| PHASE | | HUMAN | VEHICLES AND EQUIPMENT | ENVIRONMENT |
| Pre-crash | Crash prevention | Information<br>Attitudes<br>Impairment<br>Police enforcement | Roadworthiness<br>Lighting<br>Braking<br>Handling<br>Speed management | Road design and road layout<br>Speed limits<br>Pedestrian facilities |
| Crash | Injury prevention during the crash | Use of restraints<br>Impairment | Occupant restraints<br>Other safety devices<br>Crash-protective design | Crash-protective roadside objects |
| Post-crash | Life sustaining | First-aid skill<br>Access to medics | Ease of access<br>Fire risk | Rescue facilities<br>Congestion |

Source: World Report on Road Traffic Injury Prevention, op. cit.

**Figure 6.7.4 Road Accident Risk Factor Matrix**

One of the most expedient ways to enhance road safety within established jurisdictional boundaries is for traffic and transportation professionals to improve the road environment. This is typically manifested in the reconstruction, or reconfiguration, of intersections via the provision of turning lanes, proper turning radii, installation of pedestrian crossings, and similar road design/layout measures. The

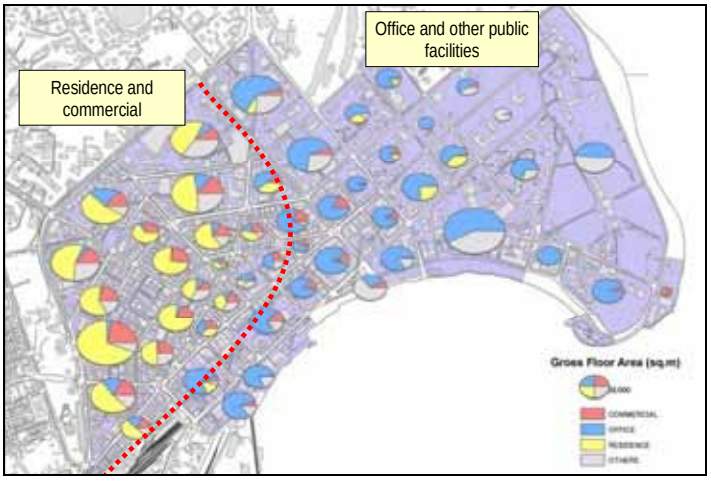
installation, and proper use, of traffic signal is also seen in positive terms from the road safety perspective. While effective, the approach is limited due to financial constraints. However, the Study Team's knowledge, in-place data management systems do not exist (although the need for this is understood) which can be used in accident "black spot" analysis. Such information is generally only available via a laborious compilation of Police records, or in project-specific instances.

A three pronged approach is suggested:

- DUTA adopt road safety as one of its pillars of action. As such, coordinated and cross-disciplinary courses of action can be initiated in line with the previously depicted (refer Figure 6.7.4) risk factor matrix.
- The Traffic Control Center can play a vital role in identifying and cataloging incidents, to include a real-time measure based on recorded incidents and vehicle exposure.
- Until DUTA and the Center are implemented, the first tier of action lies with the Police. While many issues exist, the formation of a computerized "black spot" accident reporting is, in the opinion of the Study Team, a priority. Concurrently, existing manpower can be employed to implement a more rigorous enforcement approach based on existing regulations and guidelines. Driver behavior and vehicle condition seem obvious choices.

# Chapter 7 Central Business District Traffic and Public Transport Circulation Plan

The CBD is the focal point of the metropolitan radial road network. Clearly it represents the main activity precinct for commercial and office activities, while also housing considerable residential pockets[1] (**Figure 7.0.1**). While diversification of activity is expected in future into major corridors, such as Morogoro Road, the CBD will retain a prominent role. Demand is consequently expected to continue being substantial; however, the focus of any solution cannot be the provision of extensive new infrastructure, but rather managing demand and optimizing operational aspects of the network in parallel with site-specific enhancements. Demand management will focus on Public transport, in particular the impending BRT Phase I project, non-motorised transport and pedestrian networks and also specific mechanisms to control the level of private car commuter trips.




Source: JICA Study Team

**Figure 7.0.1 CBD Floor Area by Type and Intensity**

The purpose of the current chapter is to develop a traffic management strategy for the CBD using a multi-pronged approach of mitigating traffic growth and managing the traffic flow through road and traffic optimizations including improvements to circulation patterns. Public transport is a key focus in

[1] Refer *Technical Report Volume 6: Dar es Salaam Transport Policy and System Development Master Plan, op. cit.* for further discussion as well as quantification of CBD land uses, mobility patterns and trip generation.

order to provide alternatives to car travel and in doing so will take into account the committed BRT Phase I system, whose implementation is expected by 2010. Short-term improvements to be implemented concurrent to the Phase 1 BRT (or prior) will be identified.

The detail of a CBD plan needs to be fully detailed in a dedicated feasibility study, based on the strategic approach outline of this section. This strategic outline includes measures to avoid creating demand; reduce demand (traffic mitigation) and traffic management and control measures.

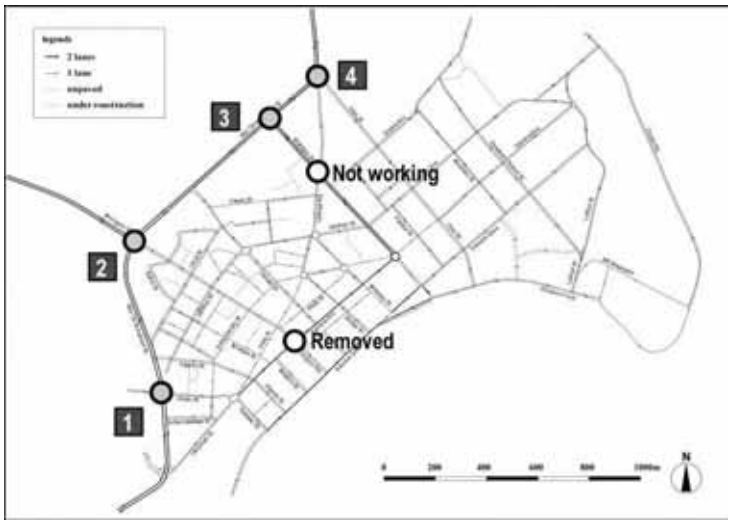
## 7.1 Overview of Existing Conditions

The CBD road network was inventoried on a segment by segment basis, to include relevant indicators as number of lanes, carriageway width, road condition, type of intersection control and operating condition. With few exceptions, such as Morogoro Road, Bibi Titi Mohammed Street and Maktaba Street, roads are of a two-lane cross-section and paved surface. In light of extensive demand, a system of one-way streets has been implemented thus increasing directional capacity as best possible. Some roads, feature both one and two operation along their alignments. Facilities such as India Street are under a variety of pressures including not only vehicular traffic, but also intense pedestrian activity as well as service truck movements (**Figure 7.1.1**).

Source: JICA Study Team

**Figure 7.1.1 Current CBD Road Network and Circulation Scheme**

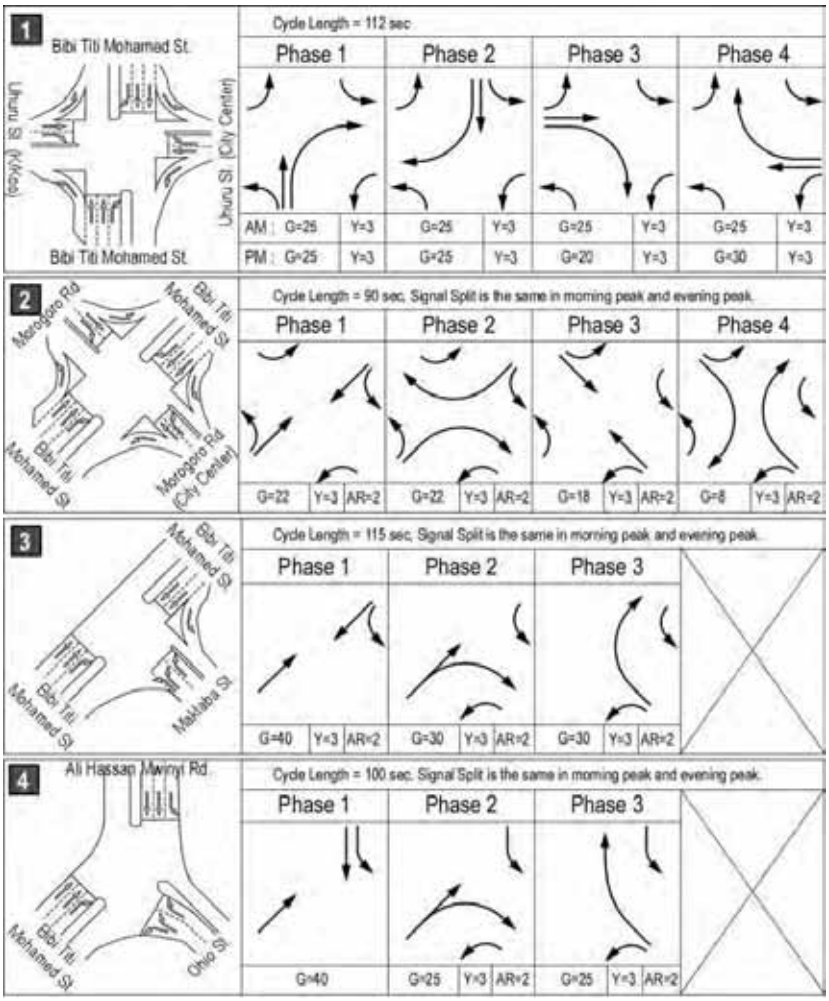
Signage and pavement markings are minimal. At most locations, key requirements such as stop line, lane demarcation, outlines of parking bays, arrows in turning lanes and similar indicators are not provided, or badly worn. As pointed out in the previous chapter, a Manual on Uniform Traffic Control Devices has recently been adopted; however, conformance is in general lacking given that most control devices were installed prior to adoption. Maintenance of signs and markings is needed. Frequently voiced reasons are a shortage of qualified staff, lack of spare parts and inadequate funding.




Source: JICA Study Team

**Figure 7.1.2 Locations of Traffic Signals**

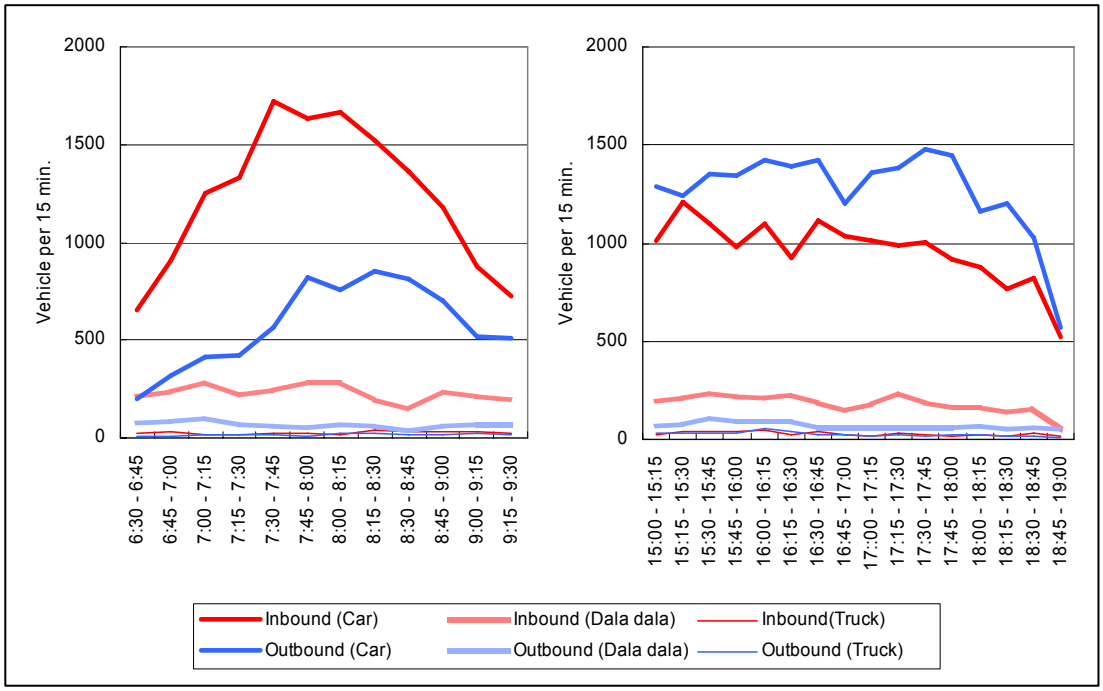
Traffic signals are located only along the periphery of the CBD (**Figure 7.1.2**). There are no traffic signals in operation in the city center. All signals except the installation at Uhuru Intersection operate at fixed time cycles during both morning and evening peak periods. Operation is via two or three phase cycles. Turning lanes are provided where permitted by space and geometrics. Small median islands offer some degree of pedestrian protection (**Figure 7.1.3**).




Source: JICA Study Team

**Figure 7.1.3 Layout and Operation of Signalized Intersections**

Eight separate locations were surveyed during peak hours to ascertain traffic volume and turning movement patterns. On a composite basis, results confirm that the morning peak is much more pronounced than the afternoon peak, which is more dispersed over the entire period. Thus, the morning peak hour represents the most critical analysis period; the temporal distribution of Dala Dala activity being relatively stable across all surveyed time periods. Furthermore, the volume of trucks entering or departing the CBD during the peak periods is modest. Thus, the majority of demand and fluctuation thereof, is due to passenger cars (**Figure 7.1.4**).




Source: JICA Study Team

**Figure 7.1.4 Composite Vehicle Demand**

The heaviest volumes were, as expected, encountered at the major peripheral roads. The intersections of Ali Hassan Mwinyi Road and Ohio Street, as well as well as Bibi Titi Mohammed Road and Maktaba Street, accommodated most volume during the three hour morning peak period. The highest single movement was inbound along Ali Hassan Mwinyi Road, a total of some 5,400 peak period vehicles (**Figure 7.1.5**).

The Master Plan home interview survey confirmed that 316,000 person trips per day enter the CBD; that is, one trip end outside and one trip end inside, the CBD. Of that total, some 142,000 use the Dala Dala mode and a further 86,000 passenger cars (or similar). Non-motorized trips constitute less than 10 percent of the total. Trips within the CBD, that is, having both trip ends within the CBD, account for a further 152,000 trips per day. Non-motorized trips are the dominant mode accounting for more than half of the total (**Figure 7.1.6**).

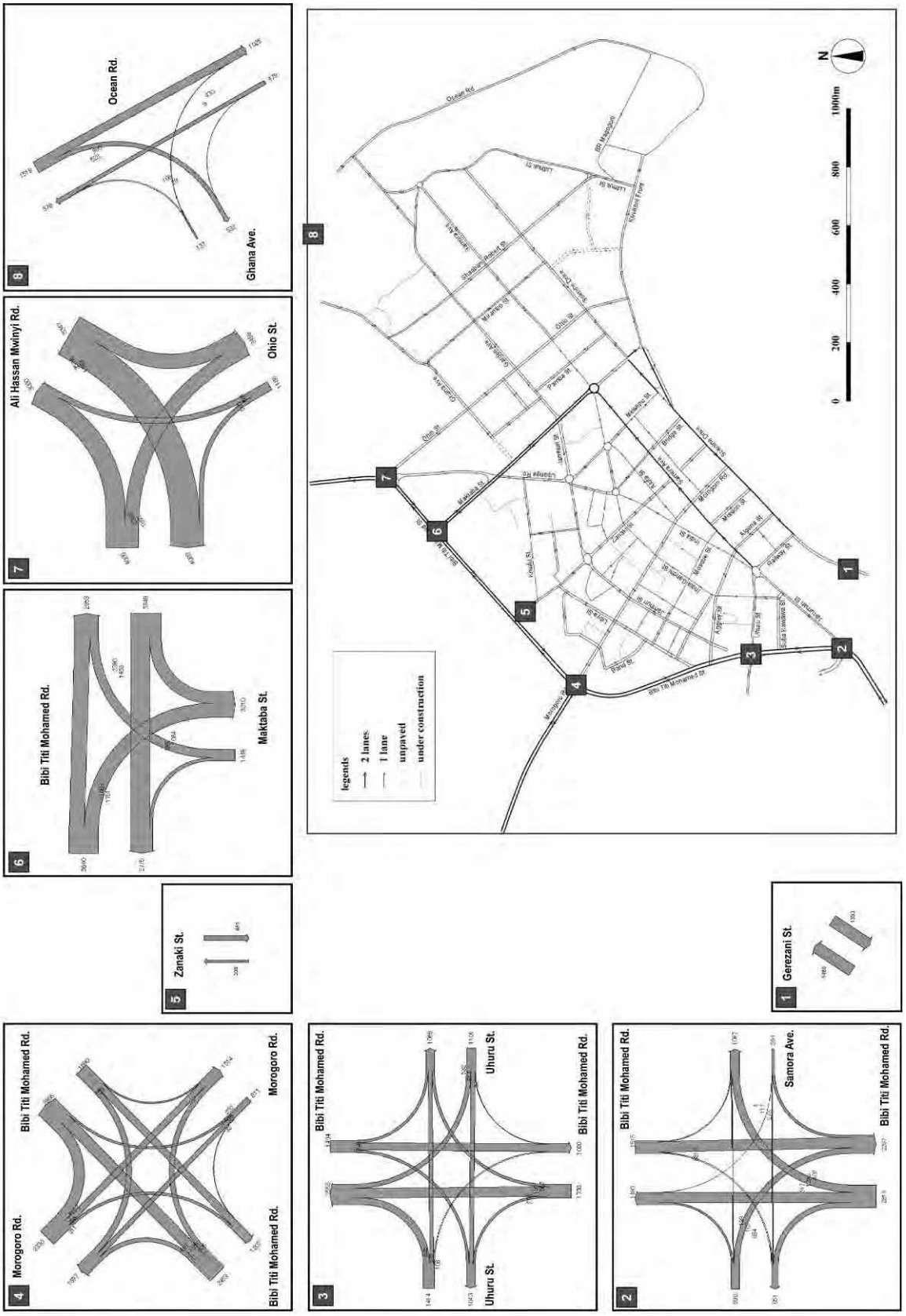
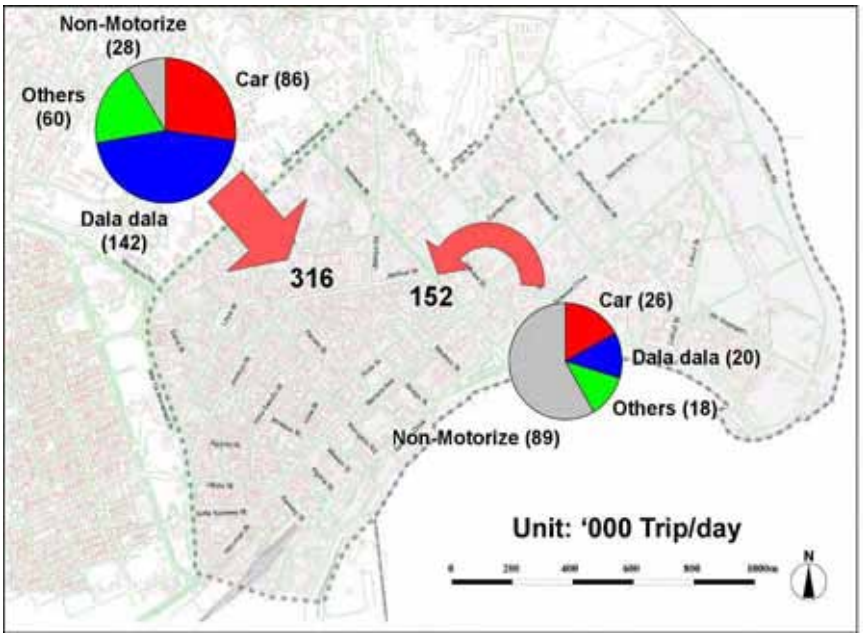



**Figure 7.1.5 Morning Peak Period (0700-0900) Vehicular Turning Movements**

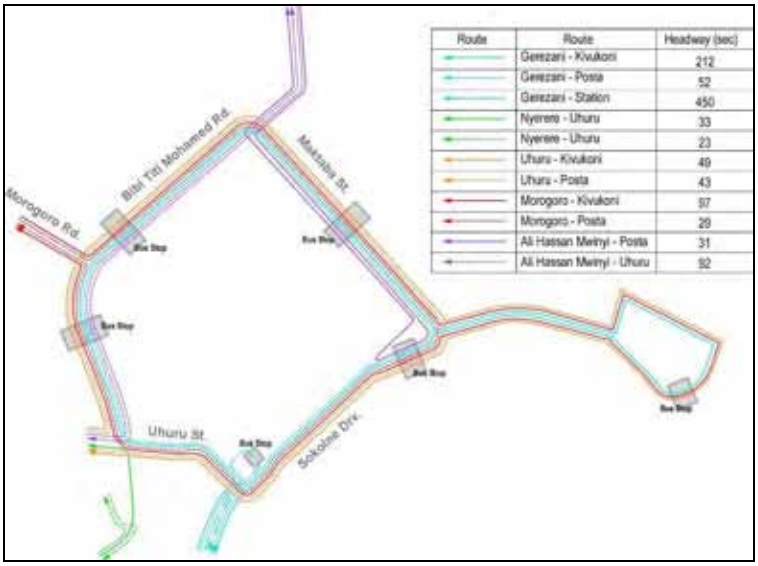
Source: JICA Study Team




Source: JICA Study Team

**Figure 7.1.6 Modal Distribution: CBD Internal and External Person Trips**

Dala Dala routes and services were obtained from SUMATRA registration records. These were subsequently verified in the field to include locations of preferred major stops. Eleven distinct routes were identified, with headways typically being less than one minute during peak periods (**Figure 7.1.7**).




Source: JICA Study Team

**Figure 7.1.7 Dala Dala CBD Routes and Service Frequencies**

## 7.2 Simulation of Alternative Scenarios

In order the gauge the performance capacity of the CBD road network, VISSIM micro simulation software was used to evaluate a variety of operating scenarios2. These include:

- The existing situation, as described in the previous subsection. Resultant numeric indicators represent benchmark values against which any alternative scenarios may be compared.
- The BRT Phase I base case traffic plan, consisting of intersection layout and design as described in the currently committed design[3].
- The same scenario as above, but including the rerouting of Dala Dala services, again in conformance with the current Phase I BRT design.
- The same scenario again, but with minor adjustments of the concept to enhance, as practical and possible, road operations.
- Finally a series of approximately 20 optimization runs, each being designed to fine tune various aspects of the road and public transport operating scheme, with the view of obtaining the best overall CBD circulation pattern. Each of the 20 optimization runs tested various types of improvements (signalization, widening, one way streets, etc) and the contribution made to overall CBD circulation efficiency. The final recommended circulation plan is based on results of the most favorable optimized simulation.

Full detail of the simulations will not be presented in the interests of brevity. The interested reader is urged to consult Technical Report 7 for complete detail.

Simulations of existing conditions have highlighted several areas of problems:

- Existing morning peak hour speeds identify several congested areas (**Figure 7.2.1**).
- Low speed sections are observed at the major intersections and Dala Dala stops along Bibi Titi Mohammed Road.
- Entrances to the Askari Monument roundabout, Clock Tower roundabout, and westbound Sokoine Drive from the Station Street intersection experience average speeds of less than 15 km/h because of congestion.

Guidelines suggest that single-lane roundabouts operate successfully to volumes of about 15,000-25,000 vehicles per day, depending on design and layout. For double lane designs, capacity increases to some 40,000-60,000 vehicles per day. Once these thresholds are exceeded there is considerable merit to replacing roundabouts by high-order signalized intersections to prevent the formation of congestions points (**Figure 7.2.2**).

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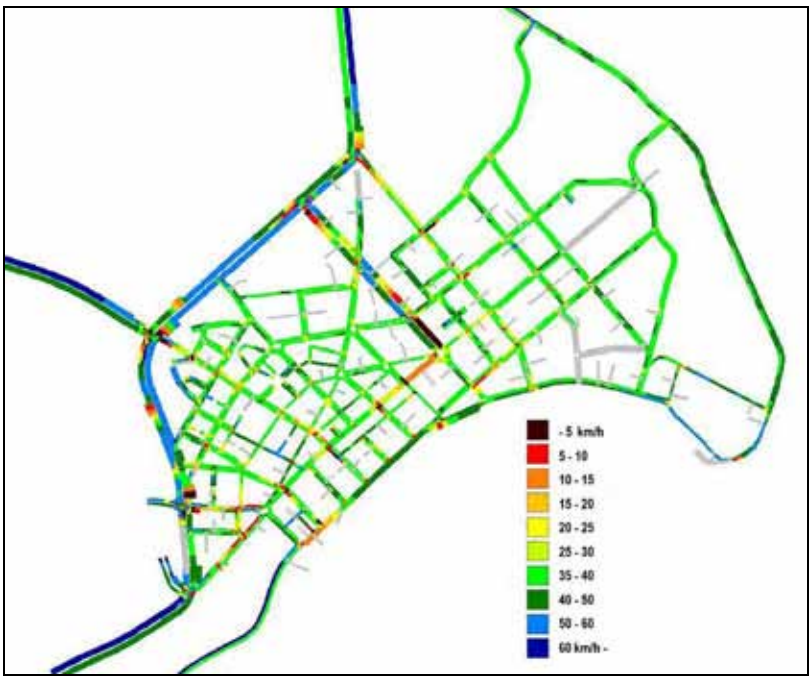
[2] Refer *Technical Report Volume 7: Dar es Salaam Transport Policy and System Development Master Plan, op. cit.* for a more detailed discussion of Master Plan modeling and simulation efforts.

[3] Per *Final Report and Project Review Seminar, Consulting Services for the Conceptual Design of a Long-term Integrated Dar Es Salaam BRT System and Detailed Design of the Initial Corridor*, op. cit.




Source: JICA Study Team

**Figure 7.2.1 Existing Average Morning Peak Period Travel Speed**

Source: JICA Study Team

**Figure 7.2.2 Simulated queue build-up at Askari Monument Roundabout indicating over-capacity conditions**

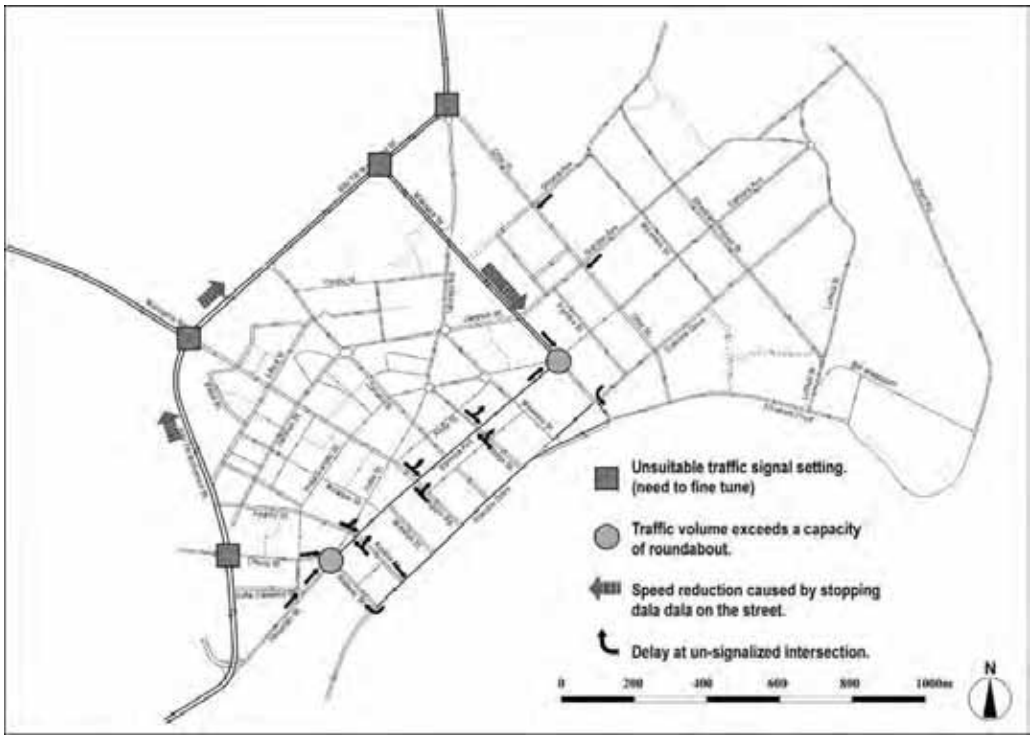
Potential areas of optimization are identified for the existing operating scheme, based on results of microscopic simulation, and depicted in **Figure 7.2.3**.

Some of these can be remedied relatively easily and have been included as short term measures in the later recommendations. In summary:

- The cycles and timing of traffic signals installed along Bibi Titi Mohamed Road should be

fine-tuned in accordance with observed traffic volume.

- The number of Dala Dala stops along Bibi Titi Mohamed Road is inadequate, or many Dala Dala drivers stop on the carriageway while loading / unloading passenger. Thus, other traffic is blocked. A similar situation exists at the Posta Dala Dala stop in that many Dala Dalas simply stop in and occupy one lane of Maktaba Street, thus reducing facility capacity by half.
- There are no operating traffic signals within the CBD; speed reductions and delay are observed at many intersections, particularly main arteries such as Samora Avenue. The capacity of roundabouts is exceeded.




Source: JICA Study Team

**Figure 7.2.3 Summary of Existing AM Peak Hour Operational Problems**

Current demand volumes were forecast to year 2009 coinciding with opening of the Phase I BRT system. Simulations of various aspects of the planned BRT Phase I circulation plan were undertaken to ascertain its success in meeting forecast demand.

The simulation concluded that the planned Phase I BRT traffic plan, and its associated modifications of roads (being most major streets converted to one-way operation; four missing links ie. Upanga Rd. – Ali Hassan Mwinyi, Ghana Ave. – Kisutu St., Jamhuri St. – Garden Ave. and BR Magogoni – Shaaban Robert St. are connected), is not capable of meeting year 2009 peak hour demand. Approximately 85 percent of forecast demand is absorbed during the simulation process. For that proportion, average travel time per vehicle increases from 4.38 to 5.43 minutes, while average vehicle delay during the morning peak increases from 1.3 to 2.08 minutes (**Table 7.2.1**).

**Table 7.2.1 Simulation of Existing Condition and BRT Phase I Committed Design**

| Indicator | Existing Condition | BRT Phase 1 (85% of 2009 demand) |
|---|---|---|
| Number of Vehicles | 22,424 | 21,037 |
| Total Distance Traveled (km) | 45,392 | 45,851 |
| Average Distance Traveled (km/veh) | 2.02 | 2.18 |
| Total Travel Time (hour) | 1,638 | 1,905 |
| Average Travel Time (min/veh) | 4.38 | 5.43 |
| Average Network Speed (km/h) | 27.7 | 24.1 |
| Total Network Delay (hours) | 485 | 730 |
| Average Delay (min/veh) | 1.30 | 2.08 |

Note: Above figures take into account only vehicles that reach their destinations within the simulated three hour period. Source: JICA Study Team

In order to maximise capacity of the CBD road network, the proposed BRT Phase I committed design was fine-tuned via a series of minor road enhancements. These include:

- Dual-lane inbound (eastbound) right turn lanes on Bibi Titi Mohammed Road at intersections of Maktaba Street and Ohio Street.
- Reversal of one-way direction along Upanga St. between Ohio St. and Maktaba St.
- Installation of traffic signal at the intersection of Bibi Titi Mohammed Road with Samora Avenue.
- Removal of Askari Monument Roundabout and installation of signalized intersection.
- Removal of Clock Tower Roundabout and installation of priority intersection.
- Installation of traffic signal at Maktaba Street intersections with Ghana Avenue and Garden Avenue.
- Return to two-way traffic flow along Ohio Street.

The simulation confirms that average delay is decreased slightly, and that average travel speed and travel time is improved over the BRT Phase I case (**Table 7.2.2**). However, the circulation system is still not capable of absorbing more than 85 percent of forecast demand.

A further series of issues emerges as a result of the minor improvements. Since capacity is increased at entrance points to the CBD, additional traffic can flow along Maktaba and Ohio Streets. Traffic congestion therefore "transfers" to intersections along these two streets. This clearly confirms that any solution cannot only involve capacity at the entrance to the CBD, but must also involve the street network inside the centre. A more balanced design is necessary which fulfills these obligations, and concurrently absorbs all forecast year 2009 demand.

**Table 7.2.2 Simulation of Existing Condition and BRT Phase I Cases**

| Indicator | Existing Condition | BRT Phase 1 (85% of year 2009 demand) | BRT Phase 1 Modified (85% of year 2009 demand) |
|---|---|---|---|
| Number of Vehicles | 22,424 | 21,037 | 20,407 |
| Total Distance Traveled (km) | 45,392 | 45,851 | 44,649 |
| Average Distance Traveled (km) | 2.02 | 2.18 | 2.18 |
| Total Travel Time (hour) | 1,638 | 1,905 | 1,833 |
| Average Travel Time (min) | 4.38 | 5.43 | 5.38 |
| Average Network Speed (km/h) | 27.7 | 24.1 | 24.4 |
| Total Network Delay (hour) | 485 | 730 | 688 |
| Average Delay (min) | 1.30 | 2.08 | 2.02 |

Note: Above figures are taking into account only vehicles that reached their destinations.

Source: JICA Study Team

A series of approximately 20 simulation runs followed, with the main goal being optimization and fine tuning of various aspects of the road and public transport operating scheme, with the view of obtaining the best overall CBD circulation pattern. A further goal was to provide sufficient capacity to absorb all forecast year 2009 demand. This was successfully accomplished, with final results presented as **Figure 7.3.1**. This Plan will referred to as Plan A – denoting the maximization/ optimization of traffic in the CBD.

The following sections outline two alternative plans; the Plan A which emphasizes traffic optimization and alternatively, Plan B with a greater emphasis on Traffic Demand Management. To illustrate the different approach between the two plans: Plan A starts with the present level of demand (forecasted to 2009 levels) and then designs the CBD network to cope with that demand as efficiently as possible. By contrast, Plan B, with a longer-term perspective, challenges the acceptance of the present demand level, questioning the balance needs to be achieved between car travel and the other functions of the city. It seeks to create a more balanced inner city precinct and then design a traffic plan that sits within the identified objectives of a liveable city. Once the unmet demand is defined and quantified it will plan and design modal alternatives to meet the unmet demand.

The Plan A attempts to make the city fit the level of traffic demand in a short-term perspective, while Plan B adjusts the traffic level to fit within a desired design of the city; a design that meets other objectives as well. The aim of Plan B is the develop action on number of fronts to reduce traffic demand to create a space where some choice is available in the future of the city.

## 7.3 Plan A – The Network Performance Maximization Approach

The 'Plan A' approach is a classic traffic management approach which redesigns the CBD network to manage traffic to its greatest efficiency; however, the simulation exercise has demonstrated that the CBD network, even under the most optimized scenario, is essentially at traffic capacity. This then draws two conclusions: being firstly, that there can be no additional road development connecting the CBD as the CBD network simply cannot cope with such increases in demand. Secondly, the traffic optimization plan is a short term option only as growth in car use is likely to overtake the improvements as soon as they are implemented.

The Plan A, however, does not ignore the need to develop public transport systems, but looks primarily at the improvements necessary towards efficient traffic management in CBD.

The core objectives of Plan A are:

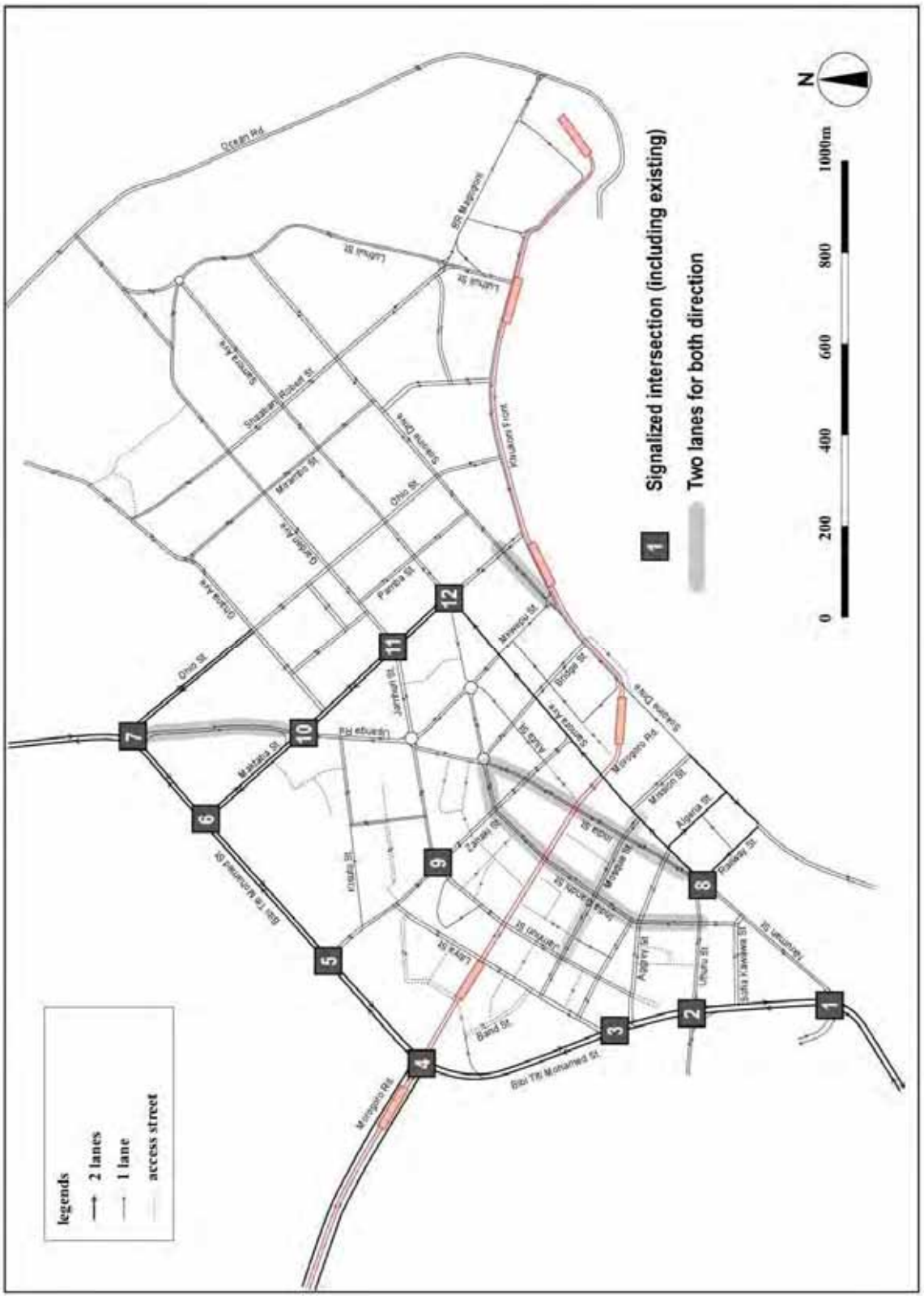
- Focus on a near-term (2009/2010) implementation of high priority projects whose realization is closely linked with, and mutually supportive of, the impending BRT Phase I project;
- Maintain maximum accessibility to CBD destinations, thus avoiding circuitous travel with consequent impacts upon the transport system;
- Maximize capacity of the CBD network with low-cost, high-impact solutions such as removal of on-street parking, signalization of intersections, judicious, use of one-way streets and strategic widening of streets in a limited number of cases; and,
- Avoid the construction major new road infrastructure; instead, focus on the provision of public transport and pedestrian facilities.

Based on these objectives, and subsequent to the completion of extensive testing, a recommended road network and parking plan was developed. This was presented to, and discussed with, various local stakeholders. Productive exchanges of information were achieved whose spirit and intent was integrated with the road plan. The major improved points are (**Figure 7.3.1**):

- Improvement of Ohio intersection with Bibi Titi Mohamed St. including connection of Upanga Street into the intersection of Ali Hassan Mwinyi Road.
- Connection Jamhuri Street to Garden Avenue.
- Connection BR Magogoni Street to Shaaban Robert Street.
- One way system along Railway Street and Algeria Street.
- Removal of on-street parking and conversion to two lanes along India Street, Indira Gandhi Street, Mosque Street and a part of Sokoine Drive.

Considerable effort was also expended on fine-tuning both the layout and operation of key intersections. In some instances, this involved the removal of roundabouts (Askari Monument, Clock Tower), provision of proper channelization and turning lanes, provision of signals, and providing signal cycling

and timing in accordance with real-world traffic demands. The intersection improvements including traffic signal configuration based on estimated future traffic volume in morning peak period are presented in **Figure 7.3.2**.




Source: JICA Study Team

**Figure 7.3.1 Recommended CBD Circulation and Parking Plan**

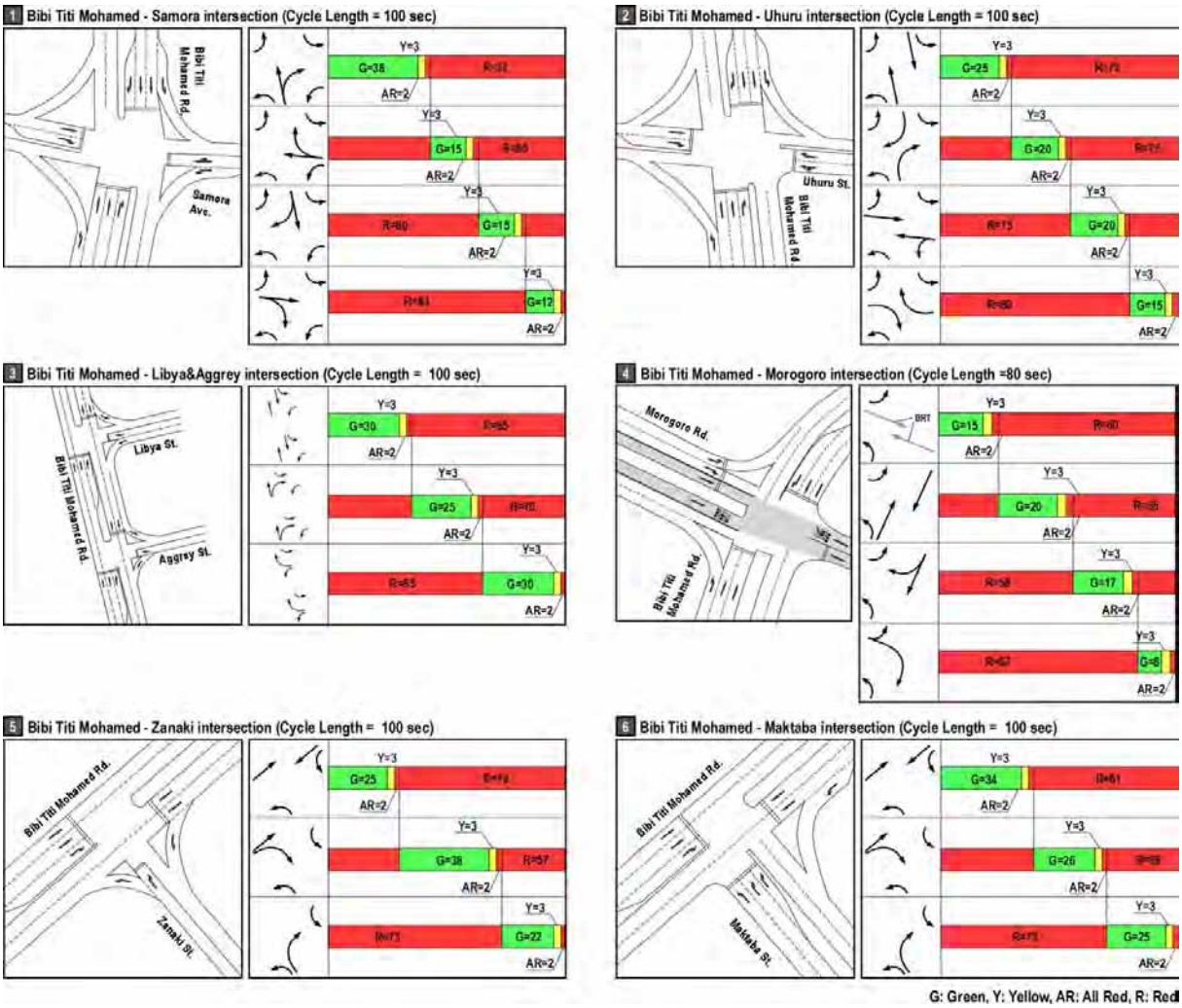



**Figure 7.3.2 Intersection Improvement Plan (Part 1 of 2)**

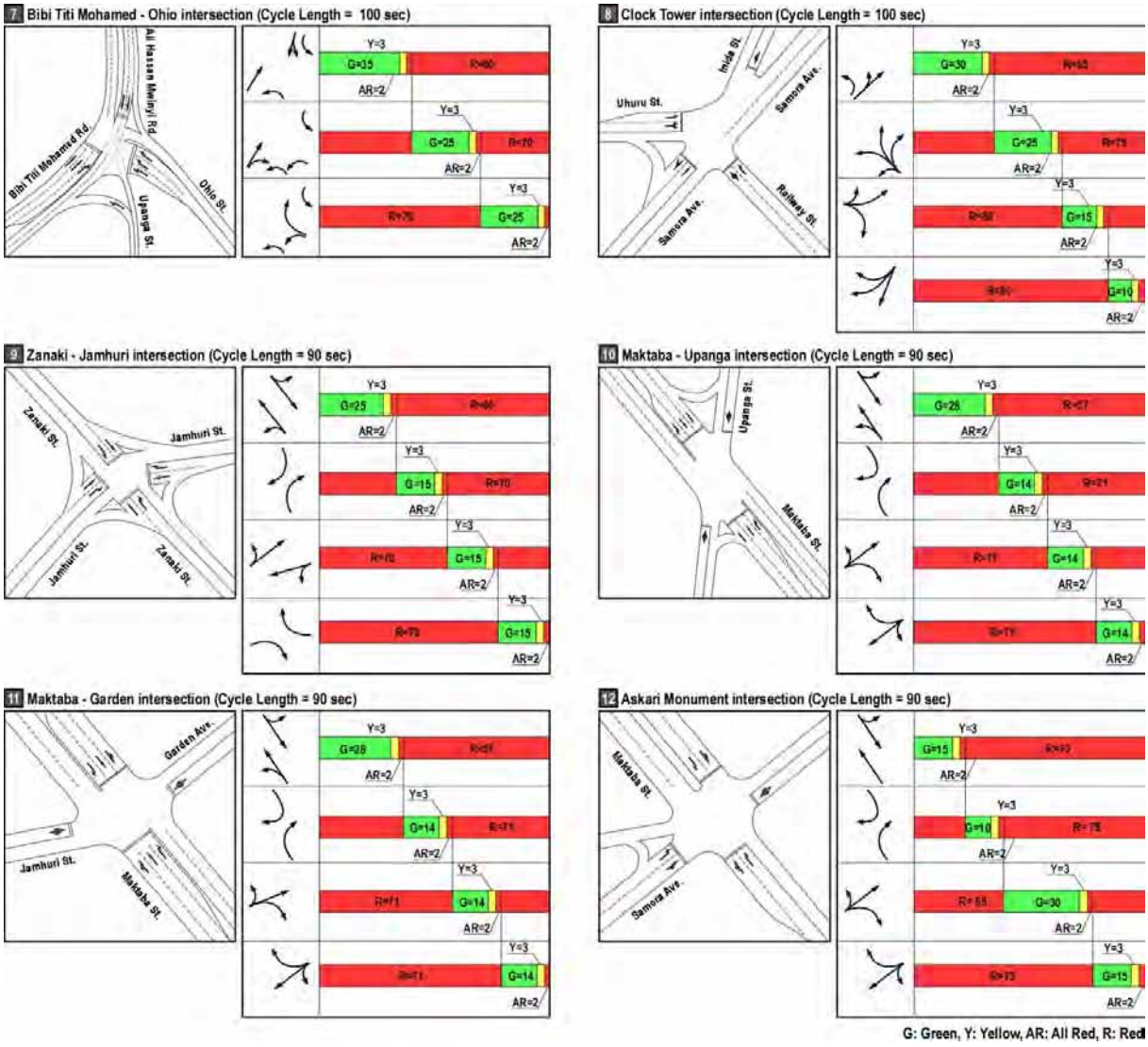



**Figure 7.3.2 Intersection Improvement Plan (Part 2 of 2)**

## 7.4 Plan B – Multi-dimensional (value add) approach with TDM

To overcome the limitations of Plan A (being limited to short-term traffic mitigation measures) a more extensive (or a different) approach is needed in a long-term perspective, specifically to install active demand management as a major thrust of the strategy, and once these measures are actualized, to manage the supply appropriately.

Overseas experience has shown that to mitigate excessive use of private modes of transport, the objective must be pursued on every front, in terms of physical ease of access, pricing, and specific incentives to use alternative transport means. In parallel, long-term comprehensive development strategies for CBD development must be adopted such as constraining high rise building development to transport capacity and pedestrian focused development to increase historical value of the city. While, Morogoro road has been identified by this Master Plan as the new focus of urban regeneration as easy transport access is provided once the Phase 1 BRT is implemented. This will take the development pressure off the CBD to retain its ambience as a Harbour city.

Traffic Demand Management is an extensive topic discussed in Chapter 6 (Section 6.4) and is raised here specifically in the context of the CBD. One major focus is increasing the total proportion of trips using public transport yet this raises great challenges. While being the most achievable measure in the short to medium term it requires active cooperation and political strength to build and implement a modern public transport system.

Consequently Plan B depends on a CBD traffic management strategy that includes:

- Long-term planning guidelines to govern land use and development so as not to create development without transport arteries (or be faced with very expensive options in the future to repair planning failures).
- Enhanced public transport options as a viable alternative to private car use including BRT as well as supporting bus route networks.
- The use of an inner city circulator bus service.
- Park and ride options
- Pedestrian streets – increase value of the heart of the city
- Cycleways and NMT facilities - ditto
- A balanced parking plan that meets essential needs without creating perverse incentives.

Given that the above are actively managed, a traffic circulation and management plan will be developed to optimize the city streets and create order including the use of active traffic management via a traffic control centre.

It should also be stressed that the future of Dar es Salaam as a competitive city relies heavily on way the CBD and the city functions. An extremely high priority is to reduce car dependency which is synergistic with strategies to cope with the rising cost of fuel and its impact on transport costs and its flow-on inflationary effects on the economy. Improving human productivity through reducing travel

time, lowering transport costs and improving economic performance could be a large positive gain from addressing the city's transport problems. This could effectively help to mitigate the future risks that loom large over the local and national economy.

Plan B therefore proposes a strategic approach containing demand mitigation as well as traffic management. The strategy is illustrated in **Figure 7.4.1** as follows:

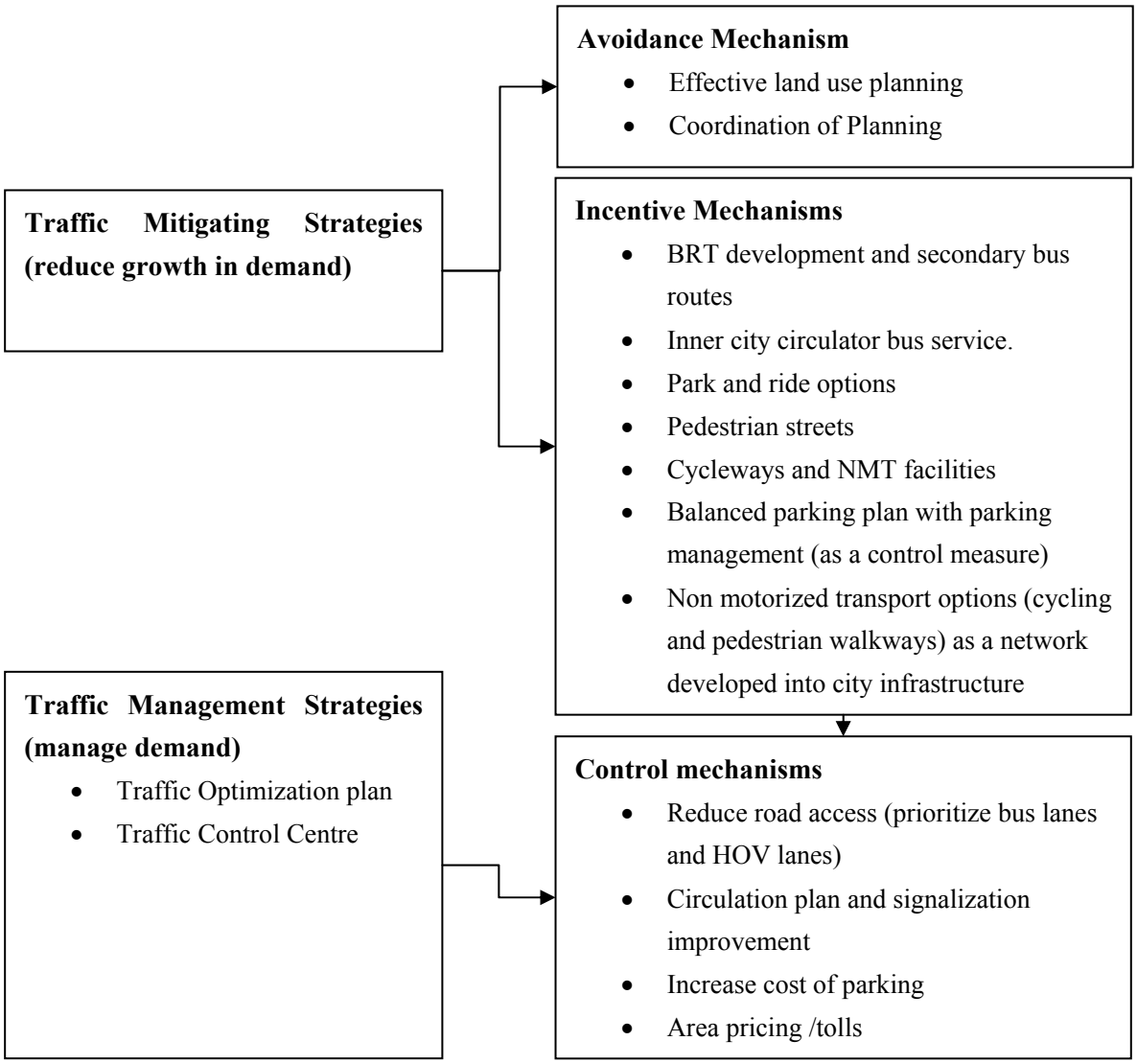



**Figure 7.4.1 Traffic Control Strategies**

## 7.5 Recommended TDM Strategies

There are three approaches to reducing traffic being avoidance (planning and land use guidelines that reduce demand), incentives for motorists to use alternative modes and lastly, control mechanisms that enforce the permissible level of traffic (such as pricing control and permits).

### 7.5.1 Avoidance Mechanisms

**Land use planning and coordination**

This is termed an avoidance mechanism in that it seeks to avoid traffic congestion by better planing to reduce demand. Land use permissions and urban design that enable communities to walk or ride to work instead of travelling large distances saves time resources and reduces the demand on mechanical modes of transport. Overseas urban regeneration has been a success story; reviving outdated industrial precincts and redesigning them into medium density housing, office space, community areas and amenities and a town centre. These designs allow communities to develop around work places thereby significantly reducing travel demand.

Coordination of planning is essential to harmonise the way the city functions, ensuring that urban development planning and transport works together for the desired outcomes. The proposed Dar es Salaam Urban Transport Authority should have active participation of the City's urban development fraternity.

### 7.5.2 Incentive Mechanisms

**BRT development and secondary bus routes**

One obvious strategy for Dar es Salaam is the development of public transport along its major entry corridors (primary arterial roads) to instigate a modal shift from private cars. This system however needs to provide a level of service and convenience similar to private car travel so it can be a 'preferred choice' rather that the option of last resort.

The dual advantage of such an approach is that by using actual road space presently used by cars, public transport (BRT or bus priority lanes) reduces space for mixed traffic thus serving as a metering device for traffic as well as providing a high mobility alternative for travellers.

The priority projects for public transport include:

- The Phase 1 BRT from the western entry of Morogoro Rd,
- The proposed further BRT phases from the southern entry point (Nyerere Rd, Kilwa Rd).
- A tidal bus priority system by using the centre lane from Selander Bridge with a Bus-only access into Upanga St to Posta and the office precinct in the northern CBD area.

It is difficult for some cities to make the principled decision to promote public transport at the expense of motor car mobility. However, the fact is that car growth in itself will determine that traffic congestion is here to stay; the only question remaining is whether the congestion occupies one lane,

two lanes or three?; and whether good alternative mobility options are provided.

The increased use of public transport is a current and prominent national objective which has seen the establishment of DART and the expected introduction of the Phase 1 BRT in 2010. Preliminary planning has been completed under the DART Operational Plan (2007) and this needs to be taken into account in the overall CBD planning. A public transport plan for the CBD should be in harmony with traffic circulation and road use assignment and design, and also consider the impacts of BRT with its initial and future phases, the secondary bus route network route and the realignment of Dala Dala routes.

**Phase 1 BRT Introduction**

The Phase 1 BRT routes will operate into the downtown area using Morogoro Rd and Sokoine Drive to the Kivukoni terminal on an exclusive busway. The introduction of this Phase 1 BRT will have a major impact on the traffic situation of the CBD, positively in the sense that offers a good public transport alternative, potentially reducing car use; but in actuality reducing the number of Dala Dala routes to the CBD; but also some negative impacts, being that the BRT in taking sole occupancy of CBD road space[4] may impact on congestion. Modal shift to the BRT will soften the impact but the problem is that BRT in its early phase will only provide service on a single main corridor and not all CBD commuters can avail themselves of the service. **Figure 7.5.1** shows the Phase 1 BRT alignment.

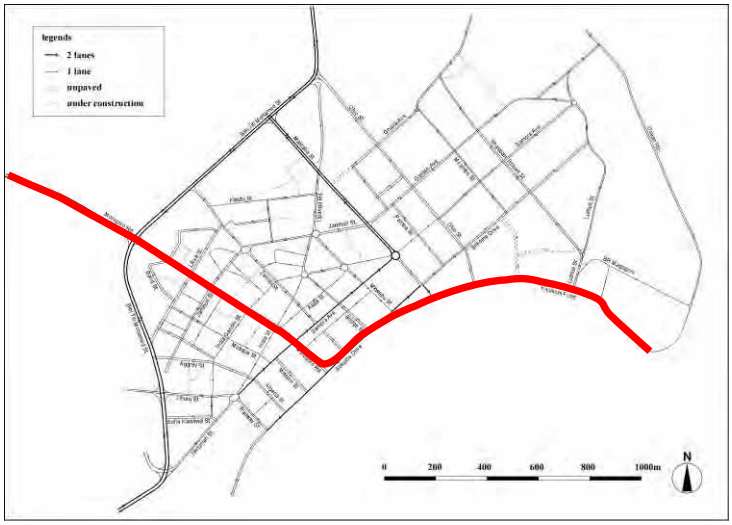



**Figure 7.5.1 BRT Phase 1 in CBD Area**

**Impact of later Phases of BRT on CBD**

Subsequent phases of BRT will see southern and western routes from Nyerere Rd, Kilwa Rd and the TRL BRT line enters to Sokoine Drive connecting at the waterfront with the Phase 1 BRT. The final layout depends on the decisions made under the Gerezani area enhancement plan as discussed in Chapter 5 of this report (Section 5.4).

[4] This resumption of road space however is not highly critical as the Morogoro Rd section from Bibi Titi Mohammed Rd to the DCC precinct is not a major arterial road and the one way design of Sokoine is maintained.

Note that the Gerezani enhancement plan is critical to connect Kilwa Rd BRT (and traffic) to the wider network and relies heavily on the use of the TRL line as a BRT corridor. If the TRL 'right to use' is not forthcoming it will require a re-examination of options to connect these BRT lines to the CBD.

**Figure 7.5.2** shows Option C of the Gerezani Enhancement Plan which operates two BRT routes from Kilwa Rd, one direct to Kariakoo and return and the other via a one way loop via Sokoine Dr to CBD (City Station) and then to Kariakoo then heading directly back to Kilwa Rd. It demonstrates the vital aspect of using the TRL line connection. The option of developing a BRT along the section of Nyerere Rd between the Kariakoo turnoff and Bibi Titi Mohammed St needs to be evaluated alongside the Gerezani /TRL line options.

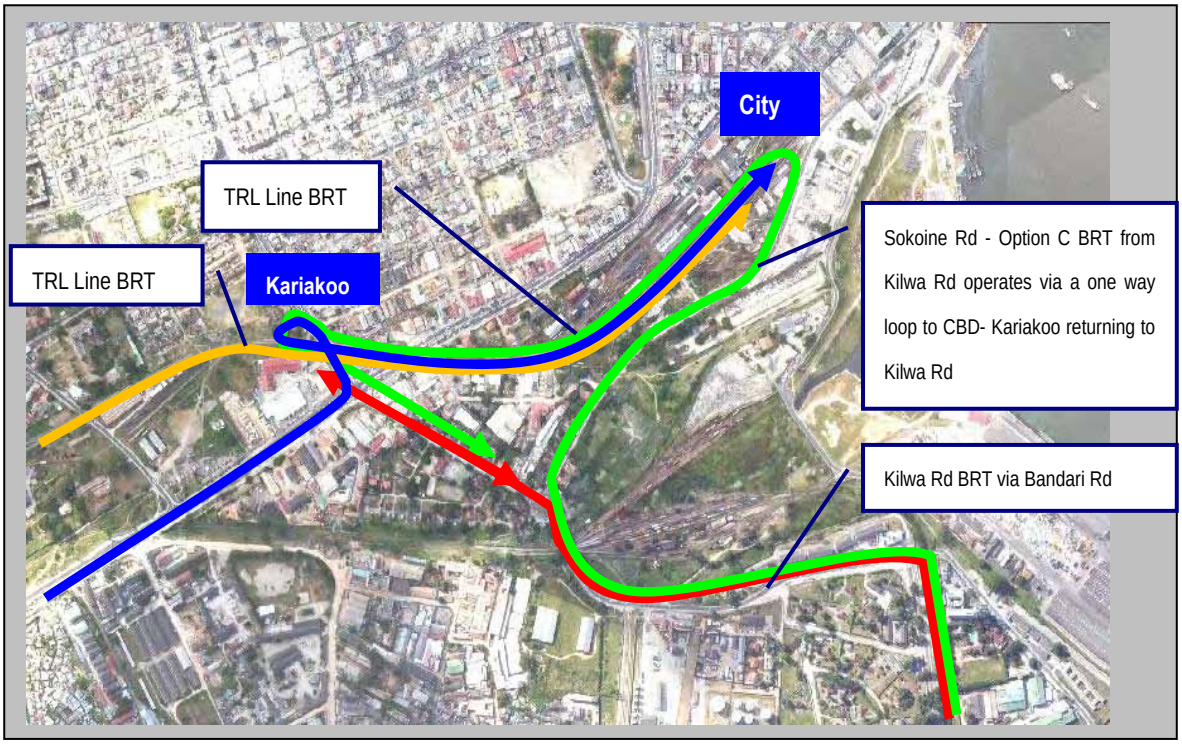



**Figure 7.5.2 Gerezani Enhancement Plan Alternatives**

**Implementing Secondary Bus Routes and a Northern Bus Priority**

A particular area of focus should be the amount of car traffic travelling to the CBD from the northern areas (Msasani peninsula) along Ali Hassan Mwinyi Rd with the primary destination being the office precinct of Ohio Rd. As this corridor is not identified as a future BRT, the early introduction of the S5 Secondary route is a good strategy that can reduce this traffic in the very near term. This proposal and the secondary route concepts are fully outlined in Chapter 11, however the CBD implication of this plan is shown in **Figure 7.5.3**.

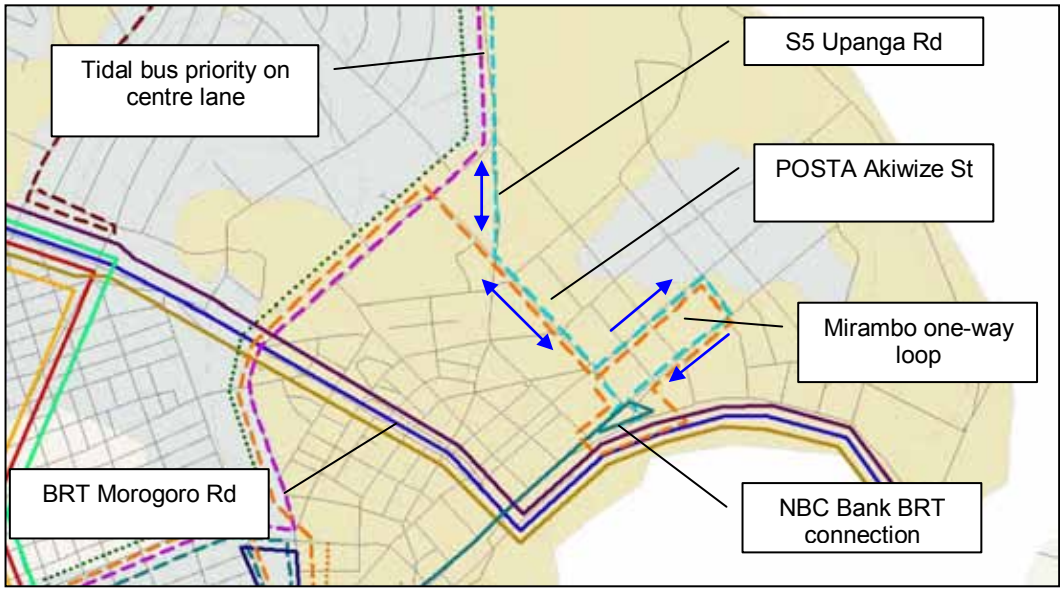
The key concept of the S5 Secondary bus route is the implementation of a high quality (air-conditioned) bus service from Msasani Peninsula which operates as a bus priority across Selander bridge, given priority by tidal flow traffic management in south of the Selander bridge to the intersection at the Movenpick Hotel and then crossing the intersection to a dedicated bus only lane into

Upanga St to connecting to Maktaba St (Posta) and travelling via a one way Mirambo St Loop connecting to Sokoine Dr where it connects to the BRT. The infrastructure needed is road markings (demarcating a bus priority) and a signalling system that controls and monitors bus movements as buses operate on the bus lane inbound in the AM and outbound in the PM. (returning buses use mixed traffic lane).

The S5 service could also connect with a future Park & Ride facility placed north of Selander bridge to reduce the traffic loads on the northern approach to the CBD.

Implementing such a bus service could be implemented under the same contractual arrangements where by operators are contracted under DART, either under one of DART's two bus operating entities or another company contracted for the purpose.

**Figure 7.5.3** shows the Upanga St dedicated Bus Priority Lane and is the continuation of a one-way Tidal Bus Priority on Ali Hassan Rd and also retains a one way access for local traffic. Route S5 enters mixed traffic on Maktaba St joining other secondary routes shown as dashed lines.




Source: JICA Study Team

**Figure 7.5.3 CBD Circulation Plan BRT Phase I and Supplementary Bus Routes**

**Re routing of Dala Dala routes**

It is expected that Dala Dala activity will decrease with advent of the BRT Phase I system, and the secondary routes. However, some Dala Dala activity will likely remain after Phase I, but be gradually reduced in scope as additional BRT phases come "on line". At present, the final status of Dala Dala lines vis-à-vis CBD services is not known, as this is dependent on further negotiations between the operators and SUMATRA. However, it is likely that some routes will continue to serve the CBD, assuming (a) those routes service precincts of Dar es Salaam not adequately covered by BRT Phase I or secondary bus routes, and (b) the route structure being so that interchange with the BRT system outside of the CBD is seen as impractical or circuitous vis-à-vis passenger desires.

The challenge is therefore to find a routing concept for remaining (post-BRT Phase I) Dala Dala services that permits efficient interchange opportunities for the mode, yet concurrently "fits" with the BRT and secondary routes concept. The proposed circulation pattern is patterned after the existing BRT Phase I Dala Dala routing plan, with appropriate adjustments (**Figure 7.5.4**). The Posta route connects with BRT at the Old Posta station and existing Kivukoni route connect with BRT at Kivukoni terminal. Route overlap has been minimized as practical and possible; however, some overlap is unavoidable given that only limited roads are available for public transport operations.

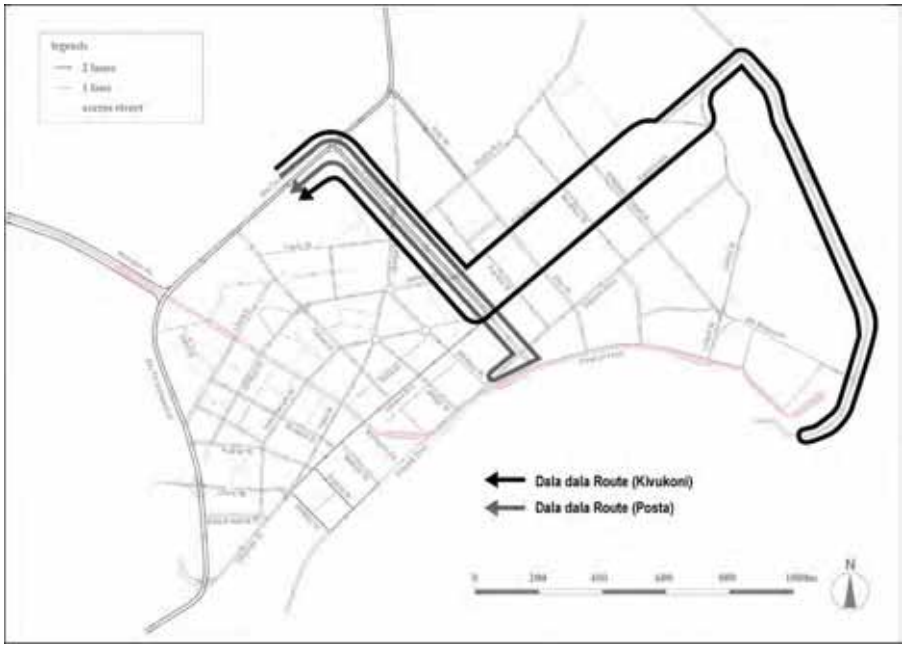



**Figure 7.5.4 CBD Circulation Plan: Dala Dala Routes**

**Inner city circulator bus service**

A greater dependence on public transport will require that commuters have easy access to a range of inner city destinations once they reach the city. An inner city distribution bus service operating at regular intervals (on a timetable) means that there is less reliance on cars. This type of bus service is common in large cities where public transport is actively promoted e.g. Perth CAT buses (City Area Transport) and are usually brightly coloured to promote the service and often are provided free, as a service to the community.

**Park/Kiss and ride options**

Promoting public transport for city related trips means that commuters must have easy access to the system from their homes. As it is not always possible to have a bus service close to every home, the availability of park and ride facilities is a way of connecting homes to the transport system by providing safe and secure parking facilities such as at a large shopping mall for people to leave their cars and travel by bus to the city. In the short term, many car trips are form the northern peninsula and

a park and ride facility in the vicinity of Ali Hassan Mwinyi Rd is a good early action to consider. This needs to be implemented in conjunction to the S5 route operating as bus priority over the Selander Bridge.

**Non-motorized transport and pedestrianization**

Dar es Salaam has some unique opportunities and advantages as far as non-motorized transport (NMT) and pedestrian modes are concerned, and can utilize these modes very effectively to improve the conditions and attractiveness of the city. Consider the following:

- The city has a flat coastal terrain with sea breezes making walking and cycling a suitable option.
- The coastal ambience the harbour city with its rich historical building lends itself to being a major tourist destination as a springboard for other Tanzanian tourism destinations. Cycling options for tourists would make the city a very enjoyable 'African city' experience and provide real benefits to the city economy as tourist would spend extra days in Dar es Salaam.
- Push carts are a common sight, used to transport good throughout the CBD in an efficient and non polluting way. But these are often persecuted as they are seen as being obstructive to traffic.

Given these opportunities, then study team supports the view of Kombe, Kyessi, Lupala, Mgonja (2003) that "a mandatory provision for non-motorised modes (bicycles, pull-/push carts) in new road design and construction projects in the city, as well as during the improvement of the existing local and arterial roads, should be instituted so as to provide for enhanced use of non-motorised transport."[5]

It is extremely important to make NMT and pedestrian-ways a network and not just a 'token' bikeway. NMT is a real and practical modal option that is mobilising, non-polluting, non-invasive, non-oil dependant, and very space efficient. Its inclusion as a major platform of inner city mobility is essential. **Figure 7.5.5** shows examples of NMT in Dar es Salaam.

[5] In: Partnerships to Improve Access and Quality of Public Transport by Prof. W. Kombe, Dr. A. Kyessi, Dr. J. Lupala & E. Mgonja University College of Lands and Architectural Studies Tanzania (Edited by M. Sohail) 2003.

The study team would like to suggest to conduct a feasibility study for cycling and NMT which should include and assess the following:

***Scope of demand and capacity*** – a cycle-way is more than just a glorified footpath; it has the potential to carry large numbers of people once a network is established. As such it needs significant capacity determined by a study of travel demand and modal switch. This demand will be enhanced if the cycle way provides improved features that provide convenience and security (such as shelter points in case of rain and lighting)

***Parking of bikes and parking security*** - a large travel demand create a flow on demand for secure bicycle parking, which needs to be built into the urban setting.

***Shelter and security*** – building shelter areas along the bikeway to accommodate cyclist sheltering from rain or resting could be an enhanced feature that encourages this mode of travel. Security also is a requirement, targeting potential areas where commuters may be vulnerable to crime. Good lighting, safe crossing points, rest areas are all areas of design that need attention.

***Tourist friendly initiatives*** – cycling is an attractive mode of travel for backpacker style tourists, and one that could be promoted by a city 'hire a bike' scheme. Linking the bikeway from the inner city pedestrian streets to the waterfront and along the northern coast forms a very interesting tourist experience.


**Figure 7.5.5 NMT in Dar**

***Accommodating and managing the use of carts*** – the use of carts is a prominent feature in Dar es Salaam and an efficient mode of transport for goods supply to the inner city. Occasionally there is friction where carts are seen as being disruptive to traffic, raising calls that they be banned. The NMT infrastructure provides an opportunity to better manage cart use so that this efficient form of goods transport is maintained. The management of carts however needs the following actions:

- Curfew on Cart use during peak (time limits) so that the cycleways are left clear for commuters during morning and evening peak times.
- Rest areas for carts; similar to the rest areas for cyclists to ensure that cart pullers have places to rest without blocking the cycle way.
- Cart storage areas – large amounts of carts are often seen stored on footpaths, therefore if this

mode is to be managed it requires that recognized holding places are provided for cart storage.

**Figure 7.5.6** shows a prospective cycleway option that provides a useful network for cycles and carts throughout the city as well as the pedestrian streets. The plan needs refinement and a detailed feasibility study but demonstrates a potential idea.

Note that the present DART Phase 1 BRT planning does not connect their proposed cycleway along Section 3 of the BRT to the city – instead it proposes to allow cyclists to use the busway on Section 2. This is not recommended for safety reasons as well as possible obstructions to the bus operation. It is therefore suggested to connect Mosque St as a combined cycleway pedestrian street to the cycleway west of Bibi Titi Mohammed which operates parallel to the busway in that section.

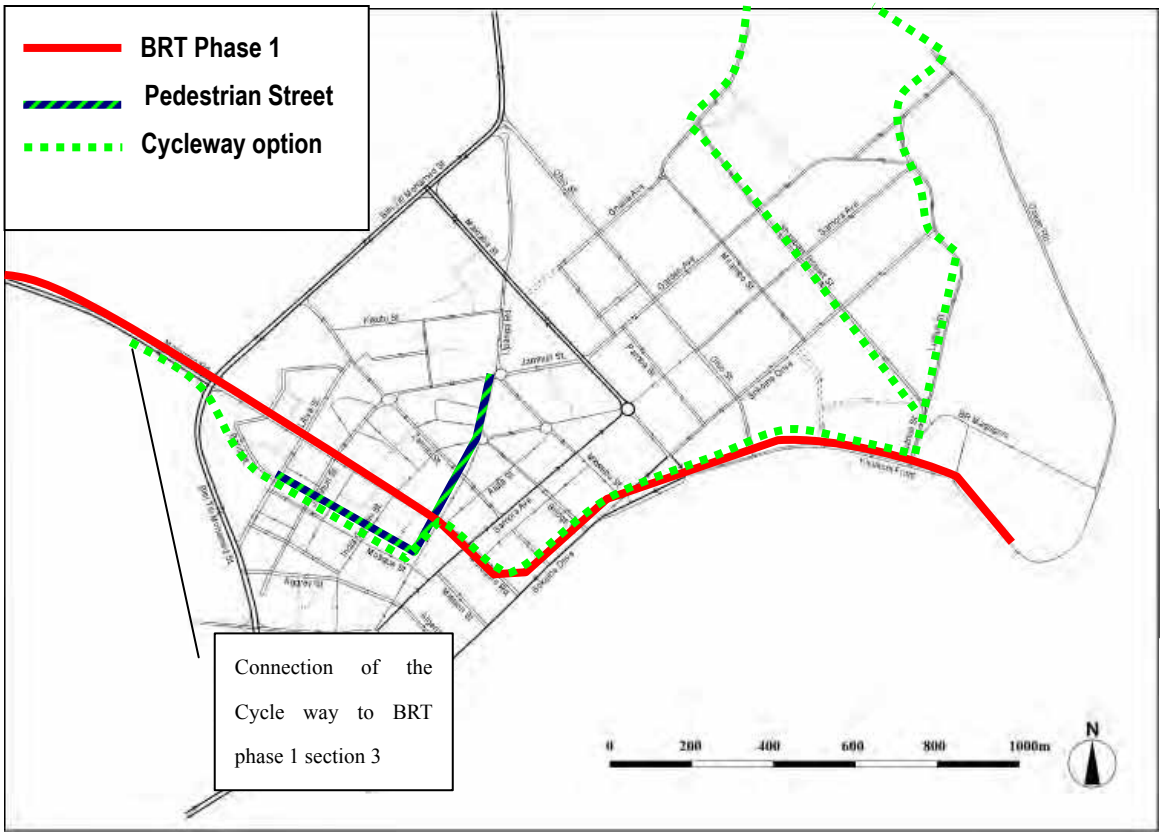



**Figure 7.5.6 Showing cycle ways and pedestrian street proposals**

**Proposed Pedestrian Streets**

A previous study[6] outlined a proposal to convert sections of India St and Mosque St to pedestrian streets which would create a pleasant inner city shopping and cafe precinct linked to the cycleway network. Making this option a reality would be an attractive tourist habitat which brings out much of the cultural background of the city.

**Figure 7.5.7** shows present streetscapes and architecture that shows the attractiveness and suitability of pedestrianization.

**Figure 7.5.7 Dar es Salaam Streetscapes**

**Balanced parking plan with parking management (as a control measure)**

An in-depth review of parking management and control is included in Chapter 6 (section 6.5) of this report.

Parking availability while often seen as a 'solution' (build more parking stations and free up roadside parking space for traffic) is actually a two-edged sword as the provision of additional parking in the CBD (to alleviate on-street parking) is self-defeating as more availability creates more demand for both parking space and road use. Development guidelines that force developers to build minimum levels of car parking space in line with the floor space size of the building is an intuitively sensible approach but fails in that it does not take into account the external costs of increasing car use.

A previous study sponsored by ITDP in 2006[7] reviewed and also detailed many of the parking issues and is a good resource for a more detailed study. One of the suggestions it made in that report is to remove the requirement on developers to provide minimum car parking places relative to the size of the building and leave it to them to determine how much is required. This is a reasonable suggestion as it removes mandatory requirements that artificially boost car parking with the resultant negative side effects which place a cost burden on the city (the cost of increasing road access space). However, car parking is a very site specific issue as the needs vary greatly with land use. For example: a shopping centre has many short term visitors needing

[6] Sponsored by ITDP: Bus Rapid Transit for Dar es Salaam, City Centre Street Typology April 2006 by Nelso Nygaard & Asscociates April 2006.

[7] Bus Rapid Transit for Dar es Salaam - Parking Management - Final Report - Nelson /Nygaard & Associates April 2006

more car park spaces compared to commuting workers whereas a corporate office building has a high number of workers who commute and usually can mange minimal areas for visitors car parks.

Consequently the strategy needs to avoid 'blanket' decrees and devise a tailored policy that creates incentives so that the desired objectives are achieved. This can involve refusing development applications and permissions for buildings that create large traffic volumes (e.g. a multistorey shopping centre) not being permitted to establish in traffic sensitive areas and are more suitably located.

Another approach is a pricing policy that taxes car parking places heavily in the property tax so that motorists are then charged by the building owners for car park use (refer Technical Report 6 Chapter 8 Car User Opinion Survey). This provides the necessary disincentive to use the car (on account of time-based cost) but also creates a revenue source for the city to invest in facilities that positively impact on city life (for example, funding to create cycle paths, greenery and pedestrian walkways). Making car parking costly, will control demand, yet also make it available to motorists where necessary.

The present management of car parking in the downtown area is a step in the right direction, as it levies a price against parking users. An improved parking plan must be developed to reduce informal and illegal parking and enforce the parking rules. However, any pricing, control and enforcement strategy should be accompanied by viable alternatives so that motorists have modal choices and that the cost levies are used as mechanisms to persuade a change of travel behaviour and practice.

### 7.5.3 Control Mechanisms

**Reduce road access (prioritize bus lanes and HOV lanes)**

There are two types of 'capacity' in dealing with CBD area, the first being the capacity of the approach roads which is a key factor in the time it takes to get to work. The second is the capacity constraint of the inner road network within the CBD, which when saturated, brings traffic movement to a virtual standstill. Both types of capacity saturation are commonly seen today indicating that saturation during some periods of the day/week is already reached.

The approach capacity actually serves as an essential metering function during the morning peak as was demonstrated in the simulation, showing that improving approach speeds transferred the problem to inner city locations. Measures to control/constraint approach capacity measures are therefore a mechanism which can be used indirectly to keep the inner city moving, or directly to encourage motorists to use alternative more space efficient means to travel to work.

Such measures include signal control, reducing or limiting, or not building extra road space on city arteries, or area pricing in CBD.

BOX – Brisbane experience

A good example of design measures to manage traffic flow occurred in Brisbane Australia where the government during the mid 1990's was faced with a dilemma, needing to widen the South East Freeway, but not wishing to promote unsustainable growth in car use, and not having the CBD capacity to manage more cars. In 1996 it opted to build a dedicated busway as an alternative to building more road space for cars and in 2003 when this became operational (with a bidirectional busway providing much needed additional capacity) it furthermore converted one of the two freeway lanes to a High Occupancy T3 lane meaning that only cars with 3 occupants could access that lane. This severely impacted on single occupancy cars and used traffic congestion to persuade motorists to use the faster public transport option. Additionally the cost of CBD parking was increased dramatically. Ultimately, growth was accommodated by public transport, and measures such as integrated ticketing have produced additional patronage showing a 70% increase in 2005-2006. This has demonstrated that a developed city with a high dependency on car use (and yet with relatively minor traffic congestion) was able to instigate a travel behaviour change as a proactive policy to develop a liveable city. Brisbane has since extended its busway links and is developing northern and eastern busways and built a 'green bridge' to the University of Queensland across the Brisbane River, for the sole purpose of bus and non-motorized traffic only.

**Figure 7.5.8 Brisbane Green Bridge**

**Figure 7.5.9 Brisbane South East Bus Way**

**Area pricing /tolls**

Once incentive mechanisms are in place (namely being good mass transit alternatives) further measures can be enforced to control the level of traffic. Area pricing mechanisms (as discussed under Traffic Demand Management in Section 6.4) can be applied and charges for vehicles entering an area.

## 7.6 Traffic Management Strategies towards Optimum Plan

### 7.6.1 The DART Phase 1 Traffic Circulation Plan

As discussed in the previous Section 7.2, the DART Phase 1 plan was evaluated through a VISSIM model. The circulation plan is shown in **Figure 7.6.1** and was designed to accommodate the Phase 1 BRT and redirect the Dala Dala. This plan is heavily dependant on one-way routes which ultimately, by increasing circuitous traffic, will create increased traffic load as cars are forced do extra distance to achieve their intended destinations.


**Figure 7.6.1 DART Phase 1 BRT plan for inner city distribution**

Further adjustment in the simulation work produced a more balanced plan (see previous **Figure 7.3.1** in Section 7.2) that allowed more two-way movement and improved certain problem areas with improved signalization. It can accommodate the year 2009 demand with the BRT Phase 1 operation and was deemed a suitable plan, but only a short-term solution.

The Plan B option is not aimed at creating maximum capacity for cars, but rather to find a level that can be described as 'optimum', with due consideration to other city objectives/values (city ambience, more space for walking, cycling, etc). The traffic plan for such a city will have less capacity overall, and rely on active demand management. The basic idea is that once this level is found, the level of capacity not met by car traffic capacity is redirected to alternative means, such as public transport. The aim will be to scope the 'unmet demand' and ensure that sufficient public transport capacity and alternatives is put in place. The proposals for a Plan B traffic circulation plan are listed as follows and shown in **Figure 7.6.2**.

- To confirm the reversal of direction of Samora Ave in keeping with the DART Phase 1 proposal for a northbound Sokoine Dr and a southbound Samora Ave. Streets connecting the southern entry via Nkrumah St to Sokoine St are Railway St Eastbound and Algeria St Westbound.
- To enhance the role of Indira Gandhi St as a one-way northbound street up to the Askari Monument Intersection
- To keep Ohio St, Maktaba St and Zanaki St as two way accesses across the main body of the city linking the bypass of Bibi Titi Mohammed St.
- To develop India St and Mosque St into pedestrian streets / cycleways connected to the Morogoro Rd BRT on the west and connected to the northern coastline via the Kivukoni Waterfront to Ocean Rd.
- Upanga St between Ali Hassan and Maktaba / Azikiwe a one way (tidal) bus priority lane with the one way northbound mixed traffic lane remaining as is, with a compulsory left turn into Bibi Titi Mohammed St.
- Disallow entry into Upanga St as a cross movement from India St to simplify the intersection
- One way configurations maintained along Garden St, Mirambo St and Samora Ave commensurate with the one way bus loop operating in mixed traffic (see **Figure 7.5.3**)
- Planned and prospective cycleways are shown as dashed green line
- Retain the Clocktower and Askari Monument roundabout in the immediate term with a possibility to convert to signals at a later stage if necessary.
- Assume other streets permitted as two way unless there is a need to limit them to improve management.

The traffic flow and road use option shown in **Figure 7.6.2** shows only the important directional flows of the major thoroughfares. In order not to be too restrictive the remaining local street can he used as two-way unless a specific reason prevails that dictates otherwise.

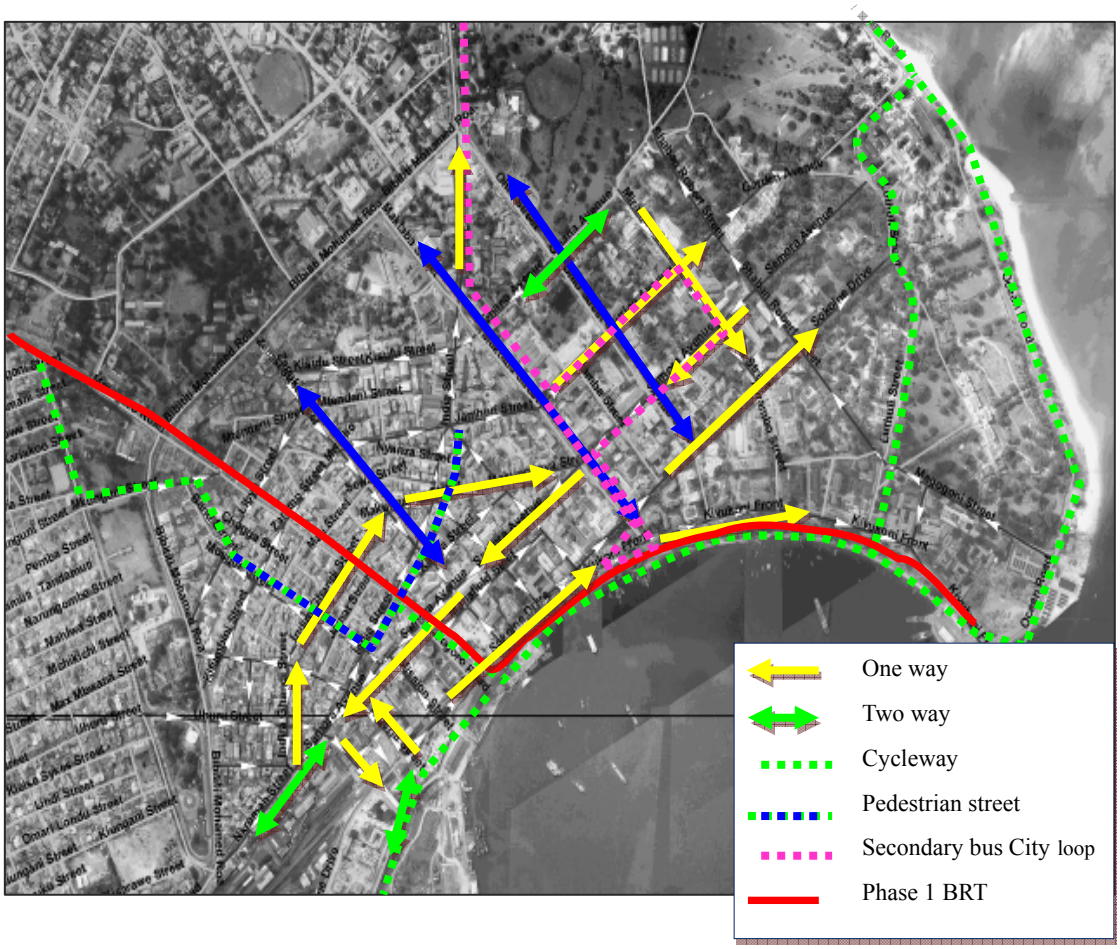



**Figure 7.6.2 A Proposed Traffic Circulation Plan based on Plan B concept**

### 7.6.2 Intersection Management

Intersection management to be developed for Plan B assumes following traffic conditions:

- Retain inner city roundabouts 8,11,12;
- Location 10 may need bus priority signal to enter Upanga St (using a transponder triggered on turn off lane) but this must be coordinated with signalling on Bibi Titi Mohammed Rd;
- Synchronization of traffic lights on locations 1 to 7; and
- Show treatments of BRT inner city (warning flashing lights) BRT right of way;

### 7.6.3 Infrastructure Issues in Traffic Management

This CBD traffic management proposal has avoided major infrastructure solutions, instead relying on a more sustainable approach of mitigating traffic demand, but also improving management strategies.

A cautionary note is made regarding the Gerezani area enhancement (as outlined in Chapter 5, Section 5.4 of this report) as it must be developed in line with proposed options. Roads and intersections simply do not possess sufficient reserve capacity to absorb additional traffic volume which would be catalyzed by new building construction in CBD which may add vehicular traffic generation. Option D for a bridge across the port area linking the CBD would be only acceptable as a BRT/NMT only

crossing in this regard.

Bibi Titi Mohammed Road functions, in effect, as a CBD "ring road", with major radial connections serving the CBD. In the future it may ne necessary to increase this circumferential capacity to three lanes per direction. However, this will need careful analysis as bottlenecks such as the Selander bridge would need to be addressed. Such decisions must be further reviewed within the broader context of the long-term road network as derived for the overall Master Plan.

### 7.6.4 Traffic Control Centre

As discussed in Chapter 6 Section 6.7.4, a traffic control centre is a key strategy to actively managing traffic in through real time information enabling a timely response to problems and issues as they arise. This level of monitoring and management can greatly assist the function of the CBD transport network, both in traffic flows, security (traffic and criminal) and response to emergencies. Typically traffic control centres are managed by an organization under DUTA with an on-site police presence but could also be managed by the Police if it lay under their jurisdiction. It is recommended however that as Police have an enforcement role, that they be separated from the 'management' of the system allowing them to carry out enforcement independently and without conflict.

## 7.7 Future Northern Access Strategies

It is evident that in future years the single northern link of the Selander Bridge will insufficient to carry anticipated demand, requiring some strategic measures to improve the northern city access. The major constraint is that the section of Ali Hassan Mwinyi Rd is space constrained and difficult to widen. The Selander Bridge presently serves both the Msasani Peninsula and areas west of the peninsula towards Mikocheni and Kawe and represents a major northern bottleneck.

The strategy to improve the northern access to meet future demand is in full alignment with the thrust of the overall Master Plan, namely to build sustainably; plan for intensive corridor of Morogoro Rd to reduce pressure on the CBD and to exploit the transport access provided by Phase 1 BRT; and lastly to avoid excessive road development especially into the existing CBD area. However, notwithstanding these goals, eventually the northern access to the CBD will need to be upgraded from a single bridge bottleneck that presently exists.

It is proposed to build a second road connection to the peninsula from the area north of Ocean Rd to by reclaiming the waterfront area east of the Selander Bridge. This tidal area forms part of the mouth of the Msimbazi River and is generally polluted and unattractive. Reclaiming this section would provide an improved link to the peninsula as well as an area for new urban development such as park and nice restaurants and shopping malls. The real estate value realized from the sale of such reclaimed waterfront land would assist to finance the bridge/ road development and furthermore creates a new development location that takes the pressure of development of the CBD. **Figure 7.7.1** shows the area in its present state.

**Figure 7.7.1 The area suitable for land reclamation alongside the Selander Bridge**

The strategy to manage this development however, needs to be governed by sound planning in order not to create unwelcome side effects: namely, the increased flow of traffic into the CBD.

This development proposal is to be seen conjunction with developed public transport options and the entire northern access treatment should be sequentially managed. The following priority represents a logical and sustainable approach.

Firstly, by placing a Bus Priority lane (in the peak hours) on the bridge to improve the passenger carrying capacity of the bridge. It is possible to use existing lanes (only in the peak hours) as a shared lane (but given priority) over the bridge or otherwise building extra two lanes on the eastern side of the bridge for southbound traffic. Developing this concept using the proposed S5 secondary bus service (as discussed in Chapter 11) will improve bridge capacity for public transport, providing good modal alternatives for car commuters, and also assist mixed traffic as much Dala Dala traffic will be reduced.

**Figure 7.7.2 Selander Bridge**

Secondly, the development of a second peninsula access road on the reclaimed section which requires strict management to promote the objectives of traffic management. This would include measures such as:

- Limiting the peak hour (through traffic) use of this road to public transport and NMT with the option to redirect peninsula bus services via this route.
- Develop this route to include cycleways via this coastal route from the CBD to the Msasani peninsula.
- Extend the BRT from Kivukoni via Ocean Rd to the new development area to connect it to the BRT network.