



PERMANENT SECRETARIAT OF THE TRANSIT  
TRANSPORT CO-ORDINATION AUTHORITY OF THE  
NORTHERN CORRIDOR  
AUTORITÉ DE COORDINATION DU TRANSPORT  
ET TRANSIT DU CORRIDOR NORD



# CORRIDOR DIAGNOSTIC STUDY OF THE NORTHERN AND CENTRAL CORRIDORS OF EAST AFRICA

## *ACTION PLAN*

### *Volume 2: Technical Papers*

#### *E. Integration of Maritime Ports with Inland Container Depots*

##### **SUBMITTED TO**

Task Coordination Group (TCG)  
Chaired by East African Community (EAC)  
Alloys Mutabingwa  
Deputy Secretary General Planning and  
Infrastructure  
Arusha, Tanzania

##### **SUBMITTED BY**

Nathan Associates Inc.  
Arlington, Virginia, USA

April 15, 2011

USAID Contract No. EEM-I-00-07-00009-00, Order No. 2  
with funding provided by USAID and DFID





# Contents

<b>Executive Summary</b>	<b>vi</b>
<b>1. Introduction</b>	<b>1</b>
Background	1
Objectives	2
Sources of Information	3
Roundtables and Peer Review	3
<b>2. Present Situation of Ports</b>	<b>5</b>
Geographical Setting and Development Options	5
Non-Containerized Cargo Facilities and Operating Systems	5
Categorization of Container Handling Facilities	6
Specialized Container Terminals	6
Conventional Container Terminals	7
Off-Dock Container Freight Stations and Inland Container Depots	8
Evaluation of Operational Performance	10
Dar es Salaam	11
Mombasa	13
Comparison to International Standards	15
Development Plans	17
<b>3. Integrated ICDs</b>	<b>19</b>
Substituting Marine Container Yards by ICD Container Yards	19
Simplifying Yard and Gate Operations and Enhancing Berth Productivity	23

Costs and Savings of Integrated ICDs System	28
The Impact of Integrated ICDs on Capacity of Marine Terminals	29
Berth Capacity Calculation	30
<b>4. Implementation of the Integrated ICD Concept</b>	<b>36</b>
Decision to Continue with the Program	36
Detailed Assessments of Program Issues	36
Small Scale Experiment	37
<b>5. Summary</b>	<b>38</b>
<b>Appendix A. Persons Interviewed</b>	
<b>Appendix B. Stakeholders' Roundtable Meetings on Integrated ICDs</b>	
<b>Appendix C. Peer Review</b>	

# Illustrations

## FIGURES

Figure 1. CDS Geographic Scope	2
Figure 2. ICD (CFS) Share and Dwell Time in Mombasa	14
Figure 3. Berth Productivity of a Specialized Terminal at the Port of San Antonio, Chile	16
Figure 4. Berth Productivity of a Conventional Terminal at the Port of San Vicente, Chile	16
Figure 5. Present Port/ICD Flow	21
Figure 6. Proposed Port/ICD Flow	22
Figure 7. Dividing the Operations of the Marine Terminal	24

## TABLES

Table 1. Berth Capacity Indicators	31
Table 2. Berth Capacity Indicators for Dar es Salaam and Mombasa Ports	33
Table 3. Berth Capacity vs. Throughput for Dar es Salaam and Mombasa Ports	33

# Acronyms

BOL	bill of lading
CD	chart datum
CDS	Corridor Diagnostic Study
CFS	container freight stations
COFC	container on flat car
CY	container yard
DRC	Democratic Republic of Congo
EIR	equipment interchange report
GRT	gross register tonnage
ICD	inland container depots
KMA	Kenya Port Authority
km	kilometers
LoLo	lift on-lift off
m	meters
MCT	Mombasa Container Terminal
MHC	mobile harbor crane
MLL	Marine Logistics Ltd.
OCR	Optical Characteristic Reader
RA	Revenue Authorities
RAHCO	Reli Assets Holding Company
RFID	Radio Frequency Identification Device
RMG	rail mounted gantry
RoRo	roll on-roll off
RTG	rubber tire gantry
RS	reachstackers
RVR	Rift Valley Railroads
STS	ship to shore
SUMATRA	Surface and Marine Transport Regulatory Authority
TICTS	Tanzania International Container Terminal Services
TAZARA	Tanzania-Zambia Railway Authority
TEU	twenty-foot equivalent unit
TOFC	trailer on flat car
TOS	terminal operating system

TPA	Tanzania Port Authority
TRC	Tanzania Railroad Corporation
TRH	Tanzania Road Haulage
TRL	Tanzania Railroad Limited

# Executive Summary

This report provides a diagnostic study of the current conditions and performance at the ports of Dar es Salaam and Mombasa, stressing capacity constraints and low productivity. An integration program is proposed as a short-term solution to alleviate such capacity constraints; by transferring cargo handling at the marine terminals container yards to near port Inland Container Depots (ICDs). Both ports have master plans including long-term development projects, including new container terminals, which would ease capacity constraints and increase berth productivity considerably. However, the issues around congestion at these ports can cause significant obstacles to port operations until these projects are completed, with new terminals expected to be commissioned at least 3 - 5 years or 2013 - 2015. The ICD Integration Program could address these issues effectively, ensuring smooth operations at these ports in the interim.

Since the terminals are already operating at full capacity or more, it is clear that without capacity enhancement there is a serious danger of the terminals going through another round of disaster of debilitating congestion, probably worse than the previous experience.

The proposed ICD Integration Program is aimed at avoiding this looming catastrophe by enhancing the capacity of the existing terminals by integrating them with ICDs. The proposed Integration Program mainly relates to institutional/operational measures; it does not require investments in new port facilities and, therefore, can be implemented in a relatively short period which can be measured in months.

The main thrust of the Integration Program is relocating all container processing activities from the marine terminals to ICDs, including all the handling of outside trucks. This "cleaning" of the marine terminals requires the integration of the ICDs with marine terminals. This integration means that the ICDs' yards substitute the marine container yards and the ICDs gates substitute the marine terminals' gate.

The suggested changes are operational/institutional measures; they do not require investments in new port facilities. They can be implemented in a short time period and effectively increase capacity at these ports in the short run.

The proposed ICDs should be located as close as possible to the sea port, unlike hinterland ICDs. Although partial transfer to ICDs has been achieved at Dar es Salaam and Mombasa ports, there is still about 40 percent

of import containers still handled at the marine terminal, which complicates ship handling and reduces berth productivity. In order to decrease dwell time of rail-bound boxes in the marine container yard, they should be moved directly from ship to the stacking area of the on-dock rail facility. Direct transfer of import boxes from the marine container yard to ICD's container yard in parallel to ship handling at berth should be set up.

With the Integrated ICDs, marine terminals will no longer need to interact with cargo owners, but only with shipping lines. A simple block storage system is recommended in the yard given all inbound boxes are destined to ICDs, which would eliminate the need for RTGs. Segmentation of the marine terminal into berth and gate sections will improve the productivity of truck handling and the entire transfer operation under the full control of ICDs. Accordingly, no cargo or equipment processing will take place at the marine terminal under the integrated ICDs system. The marine terminal will be transformed into a ship handling facility, with ICDs acting as "branches" of the terminals; thereby creating a "greater port" system.

Road connection between ICDs and ports will be improved and traffic surrounding the ports is expected to decrease. It is proposed that shipping lines contract with ICDs, where prices would be set according to performance level, which would introduce competition between the ICDs. The Program includes a system for licensing and regulating ICDs, given that their role will increase under the proposed changes. For those importers who claim their cargo directly at the marine terminals finding the program too costly, the program could be modified to allow a dwell time of three or fewer days to remain at marine terminals (partial implementation). If the Program is effectively implemented, the present truck turnaround time of four to eight hours can be reduced to less than one hour.

Regarding the cost and savings of the Integrated ICD system, the additional cost involved with the extra handling with ICDs is at least four times less than the congestion surcharge imposed by shipping lines. In addition, truck turnaround time will be reduced at least four-fold. Another benefit expected by the Integrated ICD system is the introduction of market-determined storage tariffs as a result of shipping lines directly negotiating with ICDs. Currently there is a system of punitive charges, which is a result of the urgent necessity to relieve severe shortage in yard space.

The initial response from port authorities, revenue and regulatory authorities and other stakeholders to the Integrated ICD Program was positive. A list of program issues that require more detailed assessment is presented in, among which are costs and benefits of the program; ship-handling productivity, dwell time of boxes and turnaround time of trucks.

In summary, the separation and specialization in the port system, marine terminals focusing on handling ships and ICDs on handling cargoes as proposed by the ICD Integration Program, is expected to increase berth productivity and capacity significantly (50-100 percent) at the ports of Dar es Salaam and Mombasa. Since the integration is mainly an institutional/organizational measure, most of the investment required will come from port authorities. The proposed program is targeted to avert a port crisis caused by dramatic increase in the cost of transportation due to low productivity and long waiting lines, similar to the one in 2006.



# 1. Introduction

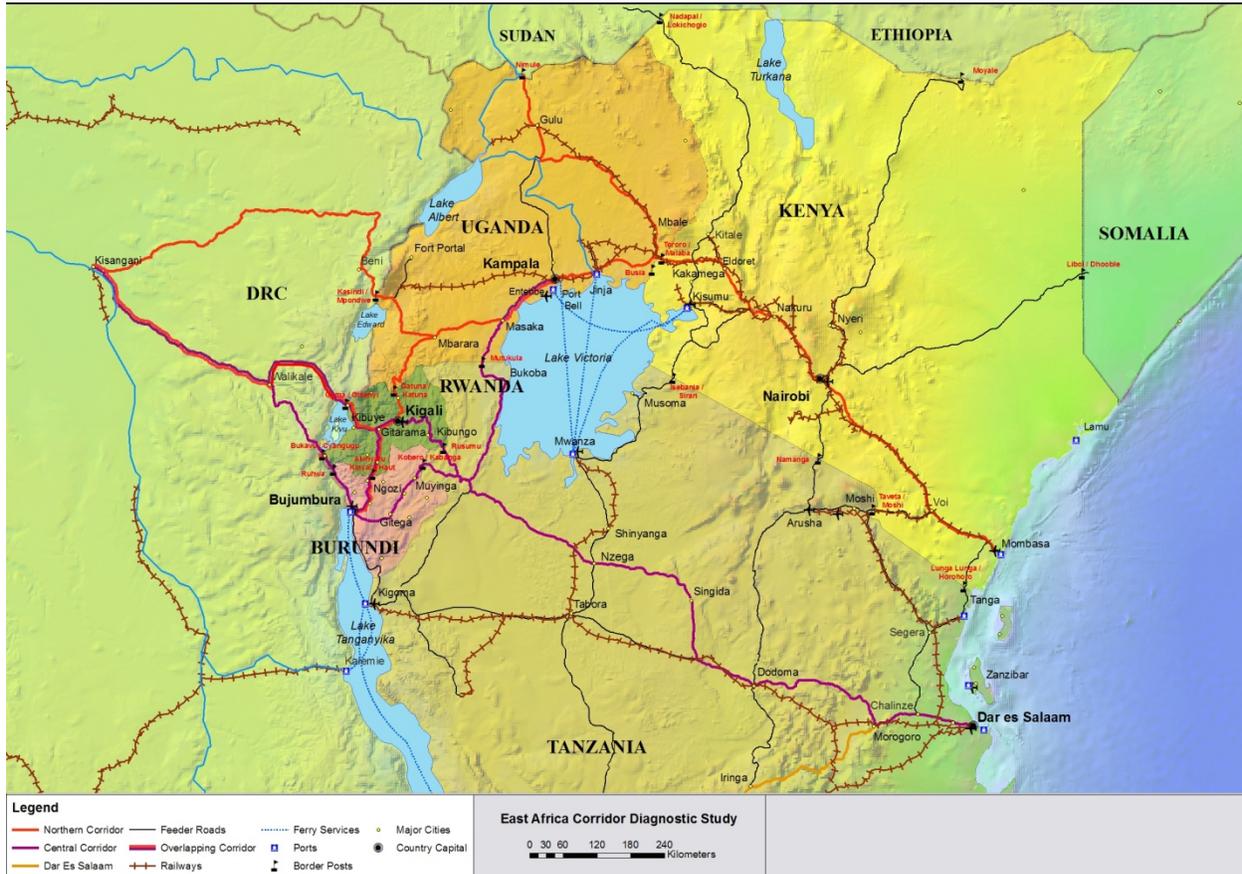
## Background

The Northern Corridor anchored by the port of Mombasa in Kenya, and the Central Corridor, anchored by the port of Dar es Salaam in Tanzania, are principal and crucial transport routes for national, regional and international trade of the five East African Community (EAC) countries, namely; Burundi, Kenya, Rwanda, Tanzania and Uganda (see Figure 1). Due to inadequate physical infrastructure and inefficiency, these corridors are characterized by long transit times and high cost. Freight costs per km are more than 50 percent higher than the USA and Europe and for the landlocked countries; transport costs can be as high as 75 percent of the value of exports. Modernization of transport infrastructure and removal of non-tariff barriers along these corridors is critical for trade expansion and economic growth, which are key to the success of regional integration as well as creation of wealth and poverty alleviation in the individual countries.

The Heads of State in the COMESA, EAC and SADC, the Tripartite, have determined that the transport inefficiencies are among the biggest impediments to realizing their vision to lead their countries out of poverty. Transport costs are prohibitively high and are a barrier to trade and investment, which are the cornerstone for the aspired economic growth to regional prosperity.

Having had the experience of successful development of an action plan to effectively tackle transport bottlenecks on the North-South Corridor, the Tripartite have ordered the preparation of a similar action plan for the key trade routes of Eastern Africa. As a technical foundation for the action plan, regional stakeholders in March 2009 agreed to carry out a Corridor Diagnostic Study (CDS) with funding from the U.S. Agency for International Development (USAID) and the U.K. Department for International Development (DFID).

Figure 1. CDS Geographic Scope



Source: Nathan Associates Inc.

## Objectives

The report summarizes a brief diagnostic study of the Ports of Dar es Salaam, Tanzania, and Mombasa, Kenya along with a proposal for a short-term reform in their operation system to expand capacity and mitigate congestion in the near term, referred to as ICD Integration Program..

The intention of the diagnosis in our study is to first examine and evaluate the operational performance of the two ports and, to a lesser degree, the adequacy of their facilities. Then, if the evaluation determined that the performance and/or facilities are inadequate, to propose remedial measures, structural and non-structural, along with implementation strategies.

Although the study involves port facilities, it is not a masterplan. Both ports diagnosed here have elaborate and updated masterplans. Usually, ports' masterplans focus on long-term development plans. Our focus is remedial measures, which can be implemented within a relatively short time and only require relatively small investments. Nevertheless, we included a few, brief critical comments on the long-term plans of these ports' masterplans along with suggested modifications.

The study encompasses all types of cargo handled in Dar es Salaam and Mombasa ports, including liquid and dry bulk, general, autos and containers. However, the emphasis here is on containers. Containers occupy most of the present port facilities and require most of the investments in the development of new facilities. Likewise, containers are the cargo with the broader public interest since general, bulk and autos tend to be a propriety cargo. Containers also account for most of the Corridors' traffic.

## **Sources of Information**

As noted above, both ports have detailed and comprehensive masterplan studies which include, in addition to future development plans, traffic forecasts, operations analyses, facilities assessment and capacity estimation. These masterplans were developed or updated in 2009 and therefore are quite relevant. We carefully reviewed both masterplans along with several additional studies, including a most recent one (June 2010) by the World Bank on the Port of Mombasa.

In light of the availability of many, recent port studies, the descriptive part of this report is limited to items considered essential to understanding the diagnostic process. Likewise, the report is targeted to readers familiar with ports and therefore avoids general descriptions of port operations and facilities.

The existing studies are an important source of information for our diagnosis. However, the main source is a series of in-depth, face-to-face interviews with port authorities, terminal operators, ICD/CFS operators and shipping lines during May, June and October of 2010. Our interviews included:

- In Dar es Salaam: Tanzania Port Authority (TPA) staff from the operations, engineering and planning departments, representatives of Tanzania International Container Terminal (TICTS), Surface and Marine Transport Regulatory Authority (SUMATRA), Tanzania Road Haulage ICD (TRH), Azam ICD and shipping lines including, MOL (Inchcape), Zim, CMA-CGM/Delmas, Maersk, Emirate, MSC and PIL.
- In Mombasa: Kenya Port Authority (KPA) staff from operations department, Kenya Maritime Authority (KMA), SDV Transami's MCT (ICD), Interpel (ICD), PIL, MOL (Inchcape), Maersk and Zim. In addition, we interviewed Maersk in Nairobi.

We also visited the marine terminals of Dar es Salaam and Mombasa along with two ICDs in each port. A complete list of persons contacted is presented in Appendix A.

## **Roundtables and Peer Review**

The study's findings, including the ICD Integration Program, were introduced and discussed in two roundtables with stakeholders in Dar es Salaam and Mombasa in October 2010. Appendix B presents a summary and participants to these roundtables.

In addition, an earlier version of this report was reviewed by a group of experts, or peer reviewers, and their input summarized in Appendix C has been incorporated.

## 2. Present Situation of Ports

### Geographical Setting and Development Options

There is some similarity in the geography of the Ports of Dar es Salaam and Mombasa; both are located on sea inlets or creeks, with long, naturally-protected shorelines on the two sides of the creek. The main facilities of both ports are located on the city side of the creek, which limits their expansion possibilities. The main difference between the settings of the two ports is that Dar es Salaam's creek is much smaller than Mombasa's in length and, especially, width.

The masterplans of both ports locate their future terminals on their creeks, in the inland portion of them. Dar es Salaam's future terminal is intended to accommodate ships of 5,000 TEUs ("max" Panamax). Developing this green-field terminal requires large investments which, in turn, require long period of recovery of 20-30 years. We believe that because of this long recovery time, the terminal should be designed to handle even larger ships such as the first or even second generation of post-Panamax with capacities reaching 8,000 TEUs. Such ships require deep channels and wide turning basin and, especially, a terminal with width of 400-500 m to provide sufficient container yards (CY) space. The terminal also requires convenient road and rail access and a large intermodal yard. It seems that locating such a terminal in Dar es Salaam's creek, as suggested by its masterplan, would be very difficult and perhaps, impractical.

Unlike the case of Dar es Salaam, Mombasa's creek is much wider and longer and can easily accommodate the future terminal(s). This, however, will require improving the navigation channel.

### Non-Containerized Cargo Facilities and Operating Systems

Both ports have facilities for handling all types of cargoes: liquid bulk, dry bulk, general, autos and containers. The liquid bulk is mostly handled by specialized jetties, with the storage provided by tank farms located outside the port. The dry bulk cargoes in Dar es Salaam are handled in conventional terminals using ship's cranes with grabs directly to trucks. Mombasa has one specialized grain berth equipped with overhead conveyor and pneumatic unloaders connected to silos outside the port. General cargo, mainly import steel and project cargo, is handled in conventional terminals using ships' gear and direct transfer to truck in most case.

In addition there is a limited volume of bagged cargo, mainly fertilizers along with bulk cargoes bagged at the port. Import cars, mostly used cars, are handled in general terminals using temporary parking lots inside the port.

All non-container cargoes are handled by direct delivery, from ship directly to truck or conveyors. In some cases, such as steel and autos, the ports allowed a short stay in the port, usually 24 hours before evacuation. Recently, autos in Dar es Salaam are also handled by direct delivery.

## **Categorization of Container Handling Facilities**

Containers, the focus of this study, are handled in Dar es Salaam and Mombasa in two types of facilities:

- Specialized Container Terminals
- Conventional Terminals

The conventional terminals also handle other, non-container cargoes. The specialized terminals handle about 70-80 percent of the total container throughput.

Unlike the non-containerized cargo, containers are not handled by direct delivery. The containers are first stored in container yards, stay several days inside the terminals and only then, are usually released.

## **Specialized Container Terminals**

### **DAR ES SALAAM**

The specialized container terminals in both ports have similar size. Dar es Salaam container terminal, Berths 8-11, consists of:

- 725 m of marginal berthage with -10.25 m depth CD alongside and 13 ha of backup area
- Four gantry, ship-to-shore (STS) cranes with the 4th erected 2010
- Rubber tired gantry (RTG) cranes-based container yard
- Back-of-terminal intermodal yard with one rail mounted gantry (RMG) crane

The terminal is operated by Tanzania International Container Terminal Services (TICTS), a private operator. It should be noted that part of this terminal, Berth 8, is still not equipped with crane rails and therefore cannot yet support the ship-to-shore cranes.

## **MOMBASA**

Mombasa container terminal (Kipevu West), Berths 16–18, consists of:

- 650 m of marginal berthage with -10.2 m depth CD alongside and about 15 ha of backup area
- Four gantry, STS cranes
- RTG based container yard
- Back of terminal intermodal yard with two RMGs

## **SMALL AND CONGESTED YARDS AND GATES**

Both Dar es Salaam and Mombasa container terminals are not designed according to the specifications of modern container terminals. Their width is about 200 m in Dar es Salaam and 250 m in Mombasa, while modern terminals' width is usually 400–500 m. As a result, their backup areas are limited. Moreover, there is no practical way of expanding these terminals' areas since in both ports the marine port facilities are cordoned by the city or other private facilities. The small backup area provides for relatively small container yards. The resulting shortage in container yards currently is the main source of terminal congestion in both ports.

A related and even more severe problem is traffic congestion inside and outside these terminals. The container yards in both ports seem to have difficulties in serving ship and gate traffic at the same time. During our visits at these terminals we observed long waiting lines of trucks inside the terminals and at both out and in gates. The result is that the STS cranes often wait for yard tractors, a major factor for the low crane productivity and subsequently low berth productivity. The ICD Integration Program is intended to increase berth productivity by relieving the traffic congestion while increasing the available container yard space.

## **Conventional Container Terminals**

### **DAR ES SALAAM**

The conventional terminal in Dar es Salaam consists of Berths 5–7 with a total berthing length of 555 m and depth alongside of about -9.5 m. Containerships calling at these berths work with a combination of five mobile harbor cranes (MHCs) and ships gear. The terminal also handles bulk and general cargoes and has transit sheds. Some of the general cargoes are shipped by railcars, with the storage and loading of wagons performed inside the terminal, blocking the internal traffic flow and taking space that otherwise could be used for storing containers. Also, while most non-containerized cargo is handled directly from ship to trucks, some of the wheat import is bagged on the dock alongside ship before loading to trucks. In addition to slowing down ship handling, the bagging operation creates traffic of outside trucks and individuals. A more elaborate discussion is provided in the next chapter.

## **MOMBASA**

The conventional terminal in Mombasa includes Berths 11–14 with a total of about 800 m of berthing length and a depth alongside of about –10 meters. As in Dar es Salaam, this terminal also handles general cargoes. Berths 13–14 are used exclusively for containers, mostly those of one shipping line. Unlike Dar es Salaam, all container handling in Mombasa’s conventional terminal is by ship’s gear. Mombasa has only one mobile harbor crane, but it is not presently used for ship handling.

## **Off-Dock Container Freight Stations and Inland Container Depots**

To ease congestion at the marine terminals, both the TPA and KPA allow the transfer of domestic import boxes to bonded Inland Container Depots (ICDs) which, inappropriately, are referred to as Container Freight Stations (CFSs) in Mombasa. Normally, a CFS involves stuffing and stripping of containerized cargo. However, very little stuffing and stripping of imported containers occur at the facilities. Accordingly, only the term ICD will be used for these facilities henceforth. Most ICDs are located outside the ports and are operated by private enterprises. Nevertheless, since these ICDs perform activities previously performed at the marine terminals, the port authorities control the operations of these ICDs and impose ports’ tariffs onto them.

## **DAR ES SALAAM ICDs**

Presently, Dar es Salaam has six licensed ICDs, with five additional ICDs under development. We visited two ICDs, TRH and Azam. TRH is the largest of Dar es Salaam’s ICDs and closest to the port, located about 2 km away. This ICD began operations in 2007 with 17 ha and has the potential to grow to 35 ha. In comparison, Dar es Salaam’s specialized container terminal only has about 13 ha. The main ICD’s facilities include a large container yard based on concrete pavers, modern reachstackers (RS), warehouses, Customs inspection shed and administration building, which also has offices for Customs and TPA. The complex is surrounded by security fence with steel gates and around-the-clock security. Azam is relatively small ICD, with a total area of about 4 ha, located about 7 km away from the port. Like TRH, the facilities, including container yard, sheds and offices are new and well maintained. Both ICDs have short access roads connecting them to the main highway leading to the port. Interestingly, both access roads are unpaved, with deep potholes, which turn muddy during rainy days. These roads also often get congested. Both ICDs declared their desire to finance the improvement of these roads but are not allowed by the City. Both ICDs are well kept.

The marine terminal/ICD transfer process is relatively simple and requires no involvement of consignees. The transfer could start immediately after boxes are discharged from ships and can be done within one day. In reality, it takes three days. We understood that part of this delay is due to cumbersome administrative processes (TICTS has to receive the boxes, TPA has to prepare invoices, collect fees, etc.), and part because TICTS can physically only load a limited number of boxes per day. Presumably, TICTS’ RTGs are busy serving ships. It should also be noted that although the ICDs are bonded, all import boxes are still scanned at the port and some of them are physically inspected.

Altogether, due to the combination of road conditions, road congestion and, especially, terminal congestion, the average roundtrip for TRH is four hours, most of it spent on waiting at the gate or in the yard. The distance to the port, as noted above, is only 2 km; at 30 km/hr, this distance requires less than five minutes. Azam reported a much longer roundtrip time of 8 - 10 hours.

According to TRH, the average dwell time of import boxes is about 15 days, of which seven days are free of storage charges. The long dwell time is attributed to Customs (see below for different dwell time in Mombasa's ICD). Azam's average dwell time is about 14 days, with about 30 percent of the boxes having dwell time of less than seven days. The importance of the latter is due to the fact that in the current tariff system, boxes released before seven days do not pay any fees to the ICDs.

The present tariff system originated at the pre-ICD era, when the marine container yards were congested. In order to encourage fast release of boxes, a punitive tariff system was imposed by the TPA, based on a short grace time followed by very high and quickly escalating fees for longer dwell times. This seems NOT to be the case anymore partially because the improvements in the releasing process (automation, etc.) have significantly reduced dwell times. Both ICDs reported a growing tendency to release boxes within the grace period of seven days. This trend is very desirable for the Tanzanian economy, except that it erodes the economic basis for the ICDs. The punitive storage fees are the main source of income for ICDs. Very few import boxes are actually stripped at the ICD and their content stored (hence the term CFS, used in Mombasa, is inappropriate). Likewise, the stuffing activity of export boxes is quite limited.

Another result of the shorter dwell time is that the storage space in both ICDs is only partially utilized.

## **MOMBASA ICDs**

Similar to Dar es Salaam, ICDs (or CFSs) were first permitted in Mombasa in 2007. At present, Mombasa has 17 ICDs, about half of them handle containers. However, it is understood that only seven are presently handling import boxes. We visited two ICDs in Mombasa, MCT and Interpel.

MCT is one of the largest ICDs in Mombasa. It is located about 5 km away from the port. The container yard at this ICD itself appears to be relatively small (5 ha), but it is part of a much larger logistic complex that also includes warehouses and auto yards. Moreover, in anticipation of growing activities, MCT has recently purchased an additional area of about 30 ha near the airport, about five to six km away from the port. Interpel has a small ICD located about one km away from the port. The construction of a new and much larger ICD, located even closer to the port, has been completed recently. Unlike the other ICDs reviewed by us, this facility has a pre-gate waiting area for outside trucks, with capacity for about 30 trucks. As was the case in Dar es Salaam, both ICDs have well kept facilities.

Also, like in Dar es Salaam, both ICDs indicated that the dwell time of import boxes has been sharply declining in the recent years. MCT reported that 60-70 percent of the boxes are released before the five days of free time expire. For comparison, only last year 70 percent of the boxes stayed more than seven days, the free time at that time. Interpel reported that this percentage reached as high as 80 percent. The main reason for the reduction

according to MCT is the punitive tariff system, whereby boxes staying longer than five days have to pay \$20/TEU-day storage charges plus re-marshalling charge of \$100/TEU. The punitive tariff system is not new. However, it is understood, that prior to the transfer of import boxes to ICDs, importers could obtain waivers from KPA for storage fees in case their boxes stayed long time in the marine container yard.

Roundtrip to the port takes about one hour during night and two hours during day, or an all average of two hours (12 trips in a 24-hour day). No data on roundtrip time was provided by Interpel but due to the short distance it should be considerably shorter.

MCT, like all other major ICDs, has a scanner for boxes. As will be seen later, as part of the Integration Program we suggest removing the scanning activities to ICDs to facilitate the traffic flow between the marine terminals and ICDs. It is interesting to observe that currently KPA is installing scanners right in the middle of the stacking area which is likely to further complicate the internal traffic flow.

## **Evaluation of Operational Performance**

### **LEVEL OF SERVICES TO SHIPS AND TRUCKS**

An in-depth discussion of port's performance indicators is beyond the limited scope of this study.<sup>1</sup> Still, a brief review is warranted here. A sea port is the transfer node between two modes of transportation water (sea, shipping) and land (road, rail). As such, the main indicators of their operational performance is the rate at which the transfers take place, or the overall time from ship-board to out-of-gate of the marine terminal for inbound containers and the reverse for outbound container. A different and more common approach to assess port performance is by assessing the level of service provided to ships on the water side and trucks and trains on the land side.

Shipping lines measure the level of port services by the total port time of their ships (buoy-in/buoy-out). The main components of port time are the waiting time for berth and the cargo handling time at berth. Ship's waiting time is closely related to berth occupancy; high occupancy usually results in long waiting times. Berth time is influenced by the number of moves (boxes, lifts) per ship call and berth productivity, usually measured by moves per berth hour. Berth productivity, in turn, is a function of crane productivity and the average number of cranes serving the ship.

Land transporters, much like shipping lines, measure the level of port services by their truck's total port time required for picking up a container, also defined as turnaround time.<sup>2</sup> This time comprises from the waiting at the entry gate (pre-gate), waiting at the stack inside the port and waiting at the exit gate. The actual handling

---

<sup>1</sup> Interested readers are welcome to review: [www.asafashar.com](http://www.asafashar.com), Port Productivity Revisited.

<sup>2</sup> Truck turnaround time varies according to activity; picking-up an import box takes more time than dropping an export box or returning an empty box. Likewise, combining the dropping of export with the picking-up of import boxes in one trip could save time.

of trucks, the lifting of box on/off it, is quite short, taking three to five minutes, depending on equipment and number of boxes that has to be removed in order to reach the desired box (“shifting/shuffling”).

Most modern ports have elaborated systems for collecting and compiling operational data, and a related system of calculating performance indicators and evaluating them. In many privatized ports worldwide, performance indicators along with rates are part of the contracts between terminals and lines, including incentives clauses, whereby higher productivity is rewarded by higher rates and vice versa.

## **LACK OF RELIABLE PRODUCTIVITY DATA**

Information regarding operational performance here is solely based on interviews with shipping lines and marine terminal/ICD operators. It should be noted that the definition of performance indicators used by various parties in the port industry are not necessarily uniform. For example, berth time may include the entire time that the ship is moored, defined as first-to-last line (line-line), or only the active portion of it when the ship is handled, defined as first-to-last box (box-box). Likewise, the number of moves may include or exclude re-handling through the dock (as one or two moves), cell-to-cell transfers, handling of hatch-covers, etc.

## **Dar es Salaam**

### **BERTH PRODUCTIVITY**

According to the Shipping Agent Association the present (May/June 2010) berth productivity at TICTS is about 15-16 moves/berth-hour. The Association has established a Port Improvement Committee which, in turn, obtained the following commitments:

- Specialized Container Terminal (TICTS) – 20 moves/berth-hour, once the new gantry crane is in full operations (TICS is expecting it by July 2010)
- Conventional Container Terminal (TPA) – 12 moves/berth-hour working with MHCs and 10 moves/berth-hour working ship’s cranes

These rates seem to be far higher than the observation made during our interviews with individual shipping lines during June 2010. These lines indicated that the productivity in handling smaller ships, with about 500 moves (in/out), was 10 moves/crane-hour. Since smaller ships were usually assigned only one crane, this also was the berth productivity. Accordingly, the berth time for handling these ships was about two days. For larger ships, handling 800-1,200 moves/call, productivity did reach higher levels of about 13 moves/crane-hour. Since these ships work part of the time with two cranes, the overall berth productivity was 15 moves/berth-hour. At this handling rate, these ships spent three to four days at berth. Participants in our Dar es Salaam workshop in October 2010 observed that recently TICTS has been reaching 20 moves/berth-hour, presumably following the commissioning of the new STS gantry cranes.

The reason for the low productivity, according to the shipping lines, was first and foremost yard congestion. The shore cranes spent much of their time waiting for yard tractors, while these tractors, in turn, were waiting for RTGs. The congestion and waiting of shore cranes is attributed to the simultaneous handling of RTGs yard tractors and outside trucks of shippers and consignees. These trucks compete with yard tractors on RTG services and also queue inside the stacks. Moreover, handling import boxes to outside trucks often requires shuffling of boxes, which sometimes may require additional five moves (TICTS operates with one over five RTGs). Another reason for the low productivity is frequent breakdowns of handling equipment, especially the 25 year old gantry cranes. Shipping lines also complained that there was a shortage in all types of handling equipment: shore cranes, RTGs, RSs and yard tractors. For example, the lines claimed that ships with 500 moves should be assigned two shore cranes and those with 1,000 moves even three cranes (depending on stowage plan).

The productivity data provided by the terminal operators was somewhat higher than that claimed by lines. TICTS claimed that crane productivity has recently increased reaching 12 moves/crane-hour. TICTS agreed that the main reason for the low productivity is congestion; in the pre-congestion period, productivity was +20 moves/crane-hour (!).

TPA claimed that their MHCs' productivity was 12-14 moves/crane-hour. Accordingly, while typically working with two MHCs, berth productivity was at times 24-28 moves/berth-hour. This productivity was similar or perhaps even exceeding that of TICTS, which explains why lines preferred directing their ships to the conventional container terminal when the container terminal was occupied.

## **SHIPS AND TRUCKS WAITING**

Ships' waiting time, according to shipping lines, ranged two to four days, which was a great improvement compared to up to 12 days previously. As seen above, berth time at TICTS for small ships was two days and for large ships three to four days. Hence, the total port time ranged from five to seven days.

No data on truck turnaround times was available. The lines indicated that it was probably six to eight hours. The long time was required due to the pre-gate, out-gate and RTG waiting along with waiting for the scanning process. Even longer waiting times were required in case of Customs verification (physical inspection). It should be noted that all containers, including those transferring to the ICDs, are required to be scanned at the port.

## **DWELL TIME**

No reliable data was provided regarding the dwell time of boxes in marine terminals, including import boxes destined to ICDs, import boxes remaining for direct release, transit boxes, export and empty boxes. Rough estimate of dwell time at the ICDs was including in the section entitled "Dar es Salaam ICDs" above.

## **CAPACITY VS. THROUGHPUT**

TPA's calculated that the capacity of TICTS in 2009 was 310,000 TEUs compared with its throughput of 326,978 TEUs. Accordingly, capacity utilization was 105 percent. It appears that TPA based its terminal capacity calculation methodology on yard capacity, similar to the methodology employed in the masterplan.

## **Mombasa**

### **BERTH PRODUCTIVITY**

The berth productivity indicated by Mombasa's shipping lines was similar to Dar es Salaam's. Crane productivity at the specialized terminal was about 10 moves/crane-hour. Since ships were mostly served by one crane, this also was the berth productivity. Larger ships, with 1,500 moves/call, were served part of the time by two cranes, reaching berth productivity of 15 moves/berth-hour. Berth productivity at the conventional terminal was not much different than that at the specialized terminal, since ships worked with their onboard cranes, usually three or four cranes at the same time, each achieving about four moves/hour. The resulting berth productivity was 13-14 moves/berth-hour. More recent observations, in October 2010, indicated berth productivity as low as 10 moves/hour.

The reasons for the low productivity indicated by Mombasa lines were similar to those indicated in Dar es Salaam: yard congestion, traffic jam inside the terminal, equipment breakdown, shortage of equipment, lack of modern Terminal Operating System (TOS) and labor motivation.

### **SHIPS AND TRUCKS WAITING**

Ship waiting in Mombasa is similar to Dar es Salaam, three to four days. No reliable information on truck waiting was available, but based on the long lines observed while visiting the terminal it seems that the turnaround time was several hours, similar to Dar es Salaam's.

### **DWELL TIME**

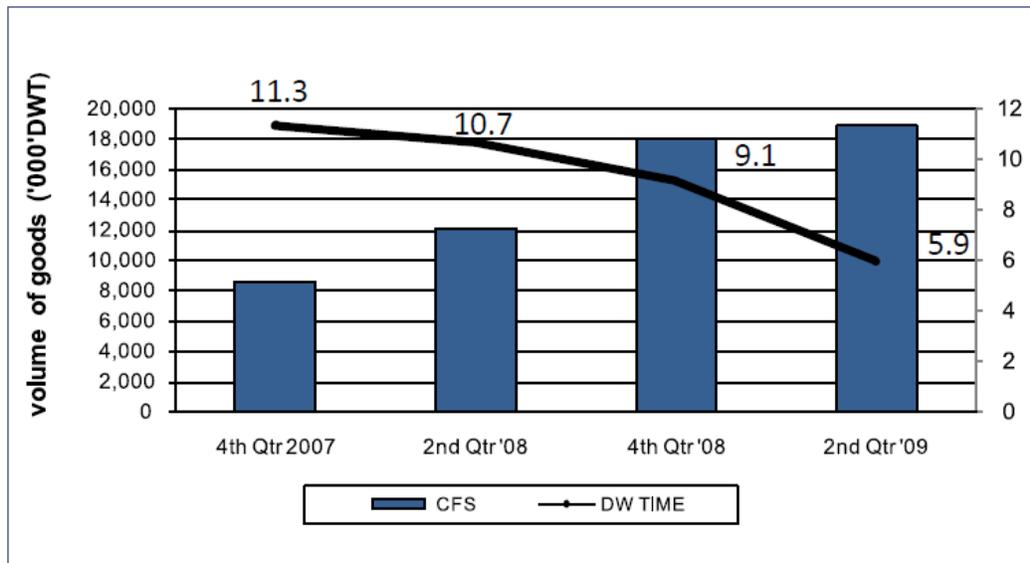
No information is available for dwell time in the marine terminals. Dwell time of boxes in ICDs was already discussed in the section on Mombasa's ICD. It was interesting to observe that lines' estimation of dwell time was much longer than that reported by ICDs. When we introduced the ICD's data on dwell time to lines they admitted that their interest was demurrage payments for their boxes than the dwell time.

The major reduction in dwell time of domestic import is one of the most important finding of this short diagnostic study. As noted in the section on Mombasa's ICD, up to 80 percent of the import boxes have dwell time of less than five days. Moreover, the ICDs indicated that the decline in dwell time would continue in the future as more and more shippers become familiar with the release process and as the process itself becomes more and more automated. It is interesting to note that both masterplans, completed in 2009 and based on data

collected in 2008, indicate a much longer dwell time of 15 days. The radical change in dwell time has far reaching implications for capacity calculation and future planning.

Recent media publications confirmed the sharp decline in dwell time. As seen in Figure 2 below, the average dwell time fell to 5.9 days in 2009 compared with 9.9 days in 2008.

Figure 2. ICD (CFS) Share and Dwell Time in Mombasa



Source: Transit Transport Co-ordination Authority of the Northern Corridor (2009).

One interim conclusion is that the long-lingering problem of excessively long dwell time of domestic import, a salient observation of almost all the studies reviewed for this study-has been essentially resolved. To re-emphasize: our study found a sharp departure the past "horror stories" about boxes held at the port for 20 or 30 days because: importers had no money to pay duties/freight/port charges; or have no space to store the merchandize; or ordered the cargo on speculations and now do not need it anymore; or do not know how to handle documents- appear to be irrelevant at present.

However, for some small percentage of shippers, the five day period is simply technically impossible to accept. These shippers import boxes on the basis of Letter of Credit, which mandate longer release process. Likewise, some shippers might be delayed by missing or improper documents. For these shippers, the present tariff system is punitive, indeed.

## THROUGHPUT VS. CAPACITY

According to media publications, the design capacity of the specialized container terminal is 250,000 TEUs. The 2008 container throughput of the entire Mombasa port was 615,000 TEUs of which 380,000 TEUs (according to BMC study) were handled at Berths 16-18. Accordingly, as was the case in Dar es Salaam, throughput greatly

exceeds capacity (150 percent), resulting in congestion and long ships' waiting times, especially in cases of operational interruptions due to weather, public holidays, etc.

## Comparison to International Standards

The performance of the container terminals of Dar es Salaam and Mombasa is unsatisfactory and, perhaps, even unacceptable. Ship's time in port varies from two days for 500-move ships to four days for 1,200-move ships to which waiting for berth time of three to five days should be added. This, as indicated above, is a result of low berth productivity of about 20 moves/berth-hour for specialized terminals and 12 moves/berth-hour for conventional terminals.

Reliable comparable operational data is difficult to obtain. Still, we were able to compile such data in our recent studies of two Chilean ports. These ports have throughputs similar to those of Dar es Salaam and Mombasa. Figure 3 present performance data taken from the Port of San Antonio in central Chile. This terminal is a 750-m specialized terminal, equipped with four older-generation ship-to-shore gantry cranes and one mobile harbor crane.<sup>3</sup> The average berth productivity was 63 moves/berth-hour, with ships usually served by an average of 2.5 gantry cranes. Accordingly, ships with 1,000 moves had a berth time of less than one day. The gate system in San Antonio is fully automated and truck turnaround time is less than one hour (!)

Figure 4 presents a similar productivity data taken from the Port of St. Vicente in southern Chile. This is conventional terminal with a 600-m berth and four mobile harbor cranes. The overall berth productivity was 40 moves/berth-hour, based on the average of 2.5 cranes/ship. The average crane productivity was 16 moves/crane-hour.

---

<sup>3</sup> The productivity in Figures 3 and 4 relate to first-to-last line. The data was compiled for an operational simulation model intended to assess the capacity of these terminals. A similar model can be developed for the East African ports to better assess their capacity under different scenarios.

Figure 3. Berth Productivity of a Specialized Terminal at the Port of San Antonio, Chile

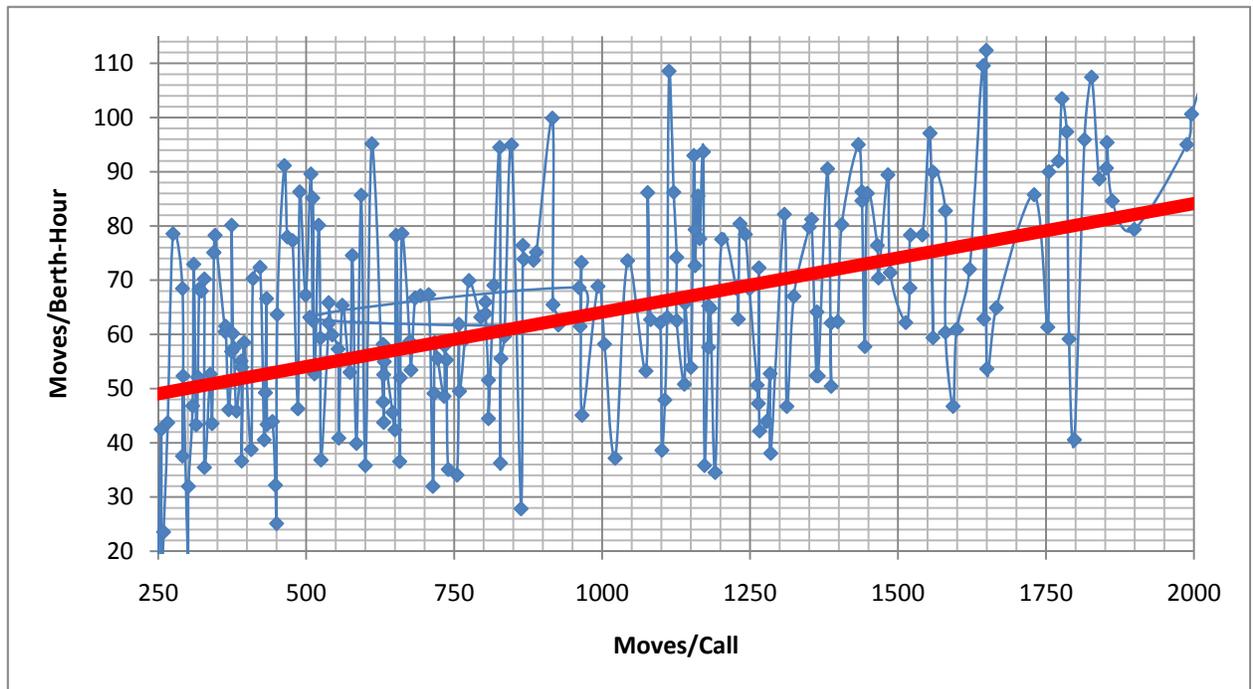
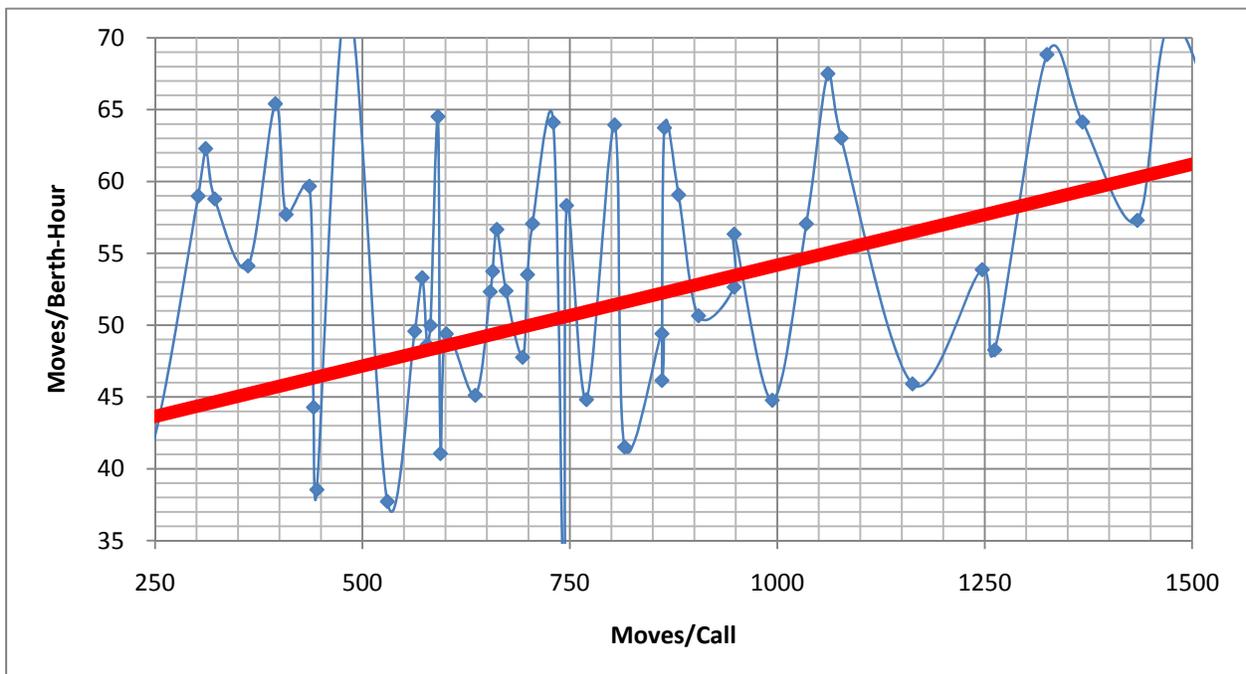


Figure 4. Berth Productivity of a Conventional Terminal at the Port of San Vicente, Chile



The present crane and berth productivity rates in Dar es Salaam and Mombasa are low even in comparison with other African ports. In our 2009 study of Lagos' terminals, we found that the specialized terminal achieved 22 moves/berth-hour, while conventional terminals achieved 19 moves/berth-hour working only with ship's gear. In our 2008 study of Accra (Tema Port), we found that the berth productivity at the specialized terminal was 23 moves/berth-hour, rising to 36 moves/berth-hour when handling larger ships. Maersk Line reported that MHCs in Conakry, Guinea regularly achieved 15 moves/crane-hour. Finally, one of the lines indicated that when Mombasa cranes were first deployed, crane productivity there also reached 25 moves/crane-hour.

We believe that if yard congestion is relieved, outside trucks removed and adequate handling equipment is available, Dar es Salaam and Mombasa could achieve similar productivity levels.

## **Development Plans**

### **SEVERE SHORTAGE OF CAPACITY**

The above review of operational performance and respective capacities of Dar es Salaam and Mombasa, especially of their container terminals, indicated severe shortage of capacity. To overcome this shortage, these ports' masterplans propose a series of expansion plans. A brief review of the main features of these plans is presented below, with plans categorized according to their implementation horizons.

Interestingly, the expansion plans do not directly address the shortage in yard space although both masterplans observed that it was the principal capacity constraint. Relieving the shortage in yard space and the traffic congestion at the marine terminals is the focus of our proposed Integrated ICD system discussed in the next chapter.

### **DAR ES SALAAM**

The main short-term (one to three years) development plans for Dar es Salaam's container facilities are:

- Installation of crane rail at Berth 8 along with a new gantry ship-to-shore crane
- Further development of the container yard at Berths 5-7
- Deepening the channel from -10.5 m to -12 m CD

The main mid-term (3-5 years) development plan includes construction of a new terminal at Berth 13-14, with a total berth length of 650 m, to allow berthing of two Panamax containerships of 5,000 TEUs (300 m LOA), with capacity of 700,000 TEUs.

The main long-term development plan includes construction of a major, green-field container terminal at a natural bay nearby Bagamoyo, a small city located 50 km north of Dar es Salaam. This project requires

substantial investment in water (channel) and land (road and rail) accesses. A feasibility study is being carried out for this site.

## **MOMBASA**

The main short-term (one to three years) development plans for Mombasa's containers facilities are:

- Berth 14 extension by 206 m, increasing the total berthing space of the specialized container terminal to 760 m and creating additional container yard area for 300 TEUs
- Berth 18 extension by 160 m and creating additional container yard area for 1,890 TEUs
- Further developments of the container yard at Berth 11-14
- Deepening the access channel to -15 m CD

The main mid-term (three to five years) development plan includes construction of a new container terminal, the Kipevu West, Berth 20-21, with 48.4 ha and capacity of 1.2 million TEUs. According to KPA, the terminal will be financed by the Japan International Cooperation Agency (JICA) and will be operational by 2013. Another recently discussed plan is to construct a new dock at Berth 11-14, aligned with Berth 16-18.

The main long-term development plan includes construction of a new, green-field container terminal on the other bank of the creek.

## 3. Integrated ICDs

### **Substituting Marine Container Yards by ICD Container Yards**

#### **THE INTEGRATION PROGRAM'S MAIN THRUST**

The prior section on Dar es Salaam and Mombasa development plans listed structural (physical) measures that these ports intend to undertake to relieve congestion and provide additional container handling capacity. Although some of the plans included in this list were termed as short-term, it is quite unlikely that a major boost to capacity will be available in less than three to five years. Since the terminals are already operating at full capacity or more, it is clear that without capacity enhancement there is a serious danger of the terminals going through another round of disaster of debilitating congestion, probably worse than the previous experience. Our proposed ICD Integration Program therefore is aimed at avoiding this looming catastrophe by enhancing the capacity of the existing terminals by integrating them with ICDs. The proposed Integration Program mainly relates to institutional/operational measures; it does not require investments in new port facilities and, therefore, can be implemented in a relatively short period which can be measured in months.

The main thrust of the Integration Program is relocating all container processing activities from the marine terminals to ICDs, including all the handling of outside trucks. This "cleaning" of the marine terminals requires the integration of the ICDs with marine terminals. This integration means that the ICDs' yards substitute the marine container yards and the ICDs gates substitute the marine terminals' gate. Since the combined ICDs container yards are much larger than the marine terminals' container yards, the Integration Program increases the overall capacity of container yards in the port system which, as will be shown in chapter entitled "Berth Capacity Calculation", determines the overall capacity of Dar es Salaam and Mombasa for handling containers.

The main impact of the "cleaning" process of the marine terminal is significant simplification of ship handling operations, which are expected to substantially increase berth productivity. Additional measures that are also required for increasing berth productivity are installation of additional shore cranes and further training and, especially, motivating the labor operating them.

## HINTERLAND VS. NEAR-PORT ICDs

The reviewers of the earlier version of this report observed, quite correctly, that the ICDs of Dar es Salaam and Mombasa are not really Inland Container Depots; they essentially are off-dock container yards. The original concept of ICDs, also defined as “dry” ports, involved relocating part of the cargo activities of the seaport to far away hinterland points, nearby concentrations of import and export cargoes, especially where convenient rail connection to the seaport was available. The commonly-quoted advantages of using dry ports were:

- Closer location to regional importers and exporters, saving the need to travel to the far away sea port
- The possibility of matching import and export loads to save an empty backhaul
- Faster collection of BOLs by exporters, upon obtaining “dock receipts” at the ICDs
- Savings in transportation costs by using consolidated mode of transports, usually unit trains, for the transport leg between the sea and the dry ports

In many cases, hinterland ICDs also included CFSs, bonded warehouses and empty depots, providing a full range of services similar to those available at or nearby the sea port.

In contrast to the hinterland ICDs, the proposed Integrated ICDs should be located as close as possible to the sea port. The difference in location reflects the difference in purpose; unlike the hinterland ICDs, Integrated ICDs are designed to serve as off-dock container yards, substituting the on-dock container yards, or those within the marine terminals.

## PARTIAL TRANSFER TO ICDs

Near-port ICDs have been used in Dar es Salaam and Mombasa since 2007 as well as in many other ports, among them Lagos, Accra, Chittagong, Lima, Limon, etc. None of these ports has fully integrated its ICDs with their marine terminals as proposed here.

Presently, the use of ICDs in Dar es Salaam and Mombasa encompasses only a small fraction of the containers. No data is available on the fraction of the containers handled by ICDs. One representative of interviewed container freight station claimed that this is less than 5 percent, while a major shipping line indicated that it is over 50 percent. We estimate this portion at about 60 percent.

The 40 percent of the import containers still handled at the marine terminal includes cases in which:

- Shipping lines elect not to use ICDs (in Dar es Salaam)
- Consignees elect not to use ICDs
- Irregular” boxes such as reefer, hazardous or oversize
- Transit and export boxes

Accordingly, the present discharge operation of ships requires differentiating between the various types of boxes while staging them in the container yard. This, in turn, complicates ships handling and adversely affect

berth productivity. In addition, later on the cargo owners of this 40 percent of the containers appear with their trucks to claim their boxes from the container yard. This truck traffic interferes with ship operation, further adversely affecting berth productivity.

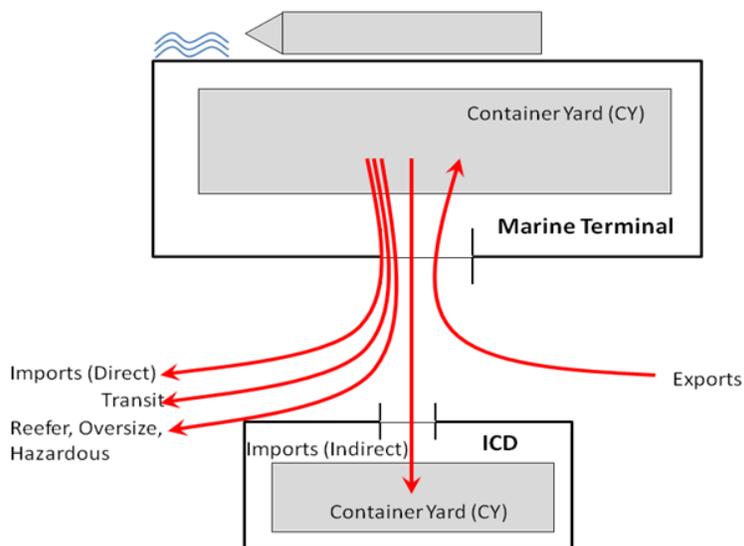
Another problem with the present ICD system is that their assignment system, which is done by the port authorities (in Mombasa) according to a formula intended to distribute the traffic “fairly” among ICDs. The result is that lines have to transfer each ship to a different ICD. This creates confusions among consignees and clearing agents. The preference of the lines is to have all their boxes at the same ICDs.

### MOVING ENTIRE SHIPS TO ICDs

Our proposed Integrated ICD system is based on transferring the entire ship, import, exports and transit to the ICD as soon as possible to the ship handling at the marine terminal. The intention is to use the marine terminal’s container yard as a temporary, pre-transfer buffer.

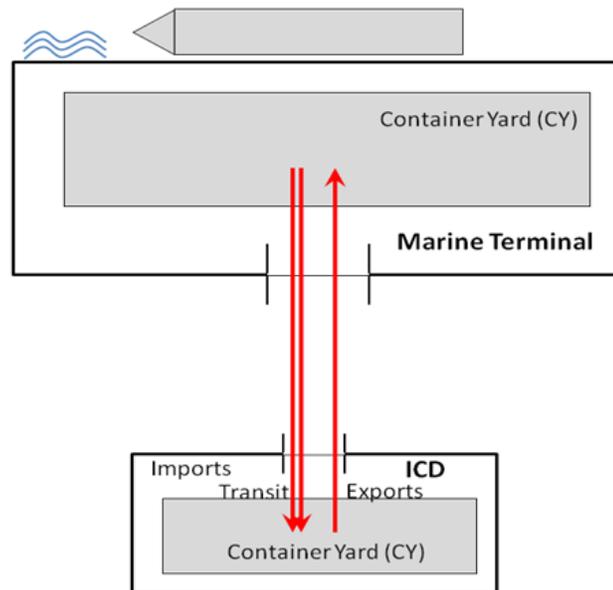
The result of such a complete and immediate transfer is that the ICDs’ container yards provide full substitution to the marine container yards and the operation of the marine terminals is significantly simplified. Figures 5 and 6 illustrate the present and proposed systems of transfer to ICDs.

Figure 5. Present Port/ICD Flow



Source: Nathan Associates Inc.

Figure 6. Proposed Port/ICD Flow



Source: Nathan Associates Inc.

## RAIL-BOUND BOXES

A substantial portion of the import boxes, both domestic and transit, is destined to far-away hinterland points and therefore should be better served by rail. However, the current percentage of boxes using rail is very low. All intermodal handling (rail car loading) are currently performed on-dock, using back-of-terminal intermodal yards. To facilitate the handling of rail-bound boxes we suggest that boxes with firm rail bookings will be moved directly from ship to the stacking area of the on-dock rail facility ("RMG" area), while the rest are transferred to ICDs.

It should be noted that transit boxes tend to stay long time in the port, taking much of the container yard storage space. Likewise, handling trucks transporting these boxes is awkward, since often it requires convoys. Hence, removal of transit boxes will contribute much to relieving the marine terminal congestion, the main thrust of the Integration Program (see below on congestion).

## PARALLEL AND DIRECT TRANSFER

The fast transfer of import boxes from the marine container yard to the ICD's container yard is the most critical element in the Integration Program. Ideally, the transfer process should be performed in parallel to the ship handling at berth. The discharged boxes should be transferred by yard tractors from shipside to a special "block" stack while, at the same time, road trucks can be loaded there underway to the ICD.

A fast transfer will allow consignees looking for fast release immediate access to their boxes, almost at the same time these boxes would be available at the marine terminals. Moreover, if parallel transfer is properly coordinated, boxes will be available even earlier at the ICD than currently at the port since presently trucks

have to wait long time at the gate and for RTGs (see more below). Parallel transfer will also reduce the buffer space required at the marine container yard.

Parallel transfer might seem very difficult to implement. However, some of the interviewed shipping lines indicated that parallel transfer has already been practiced in Mombasa in several of their ships; by the time the shore handling of their ships was completed, most of the boxes were already at the ICD. Accordingly, once the Program is implemented, including modifying gate processing and improvement of access roads (see below), the evacuation of the entire ship could be completed within 24 hours.

Unlike containers, general and bulk cargos are handled via direct transfer or ship-to-outside trucks. This raises the question of why not pursue a direct transfer for containers eliminating entirely the need for container yard. Unlike general cargo, coordinating direct transfer for containers is very difficult because of significantly higher demand for trucks and the cost of ship waiting for trucks. For example, if following the implementation of the Integration Program berth productivity reaches the 40 or 50 moves/berth-hour, the supply of trucks alongside the ship should also reach 50 trucks/hour. The number should be double or triple if two or three ships are handled at the same time. Because of the variations in trucking time, maintaining a steady flow of trucks would require a very large and dedicated fleet of trucks in order not to delay ship operation. It should be noted in this respect that we are not aware of any major container port worldwide that practices direct transfer of containers on a large scale.<sup>4</sup>

## **Simplifying Yard and Gate Operations and Enhancing Berth Productivity**

### **BLOCK STOWAGE AND REACHSTACKERS REPLACING RUBBER TIRED GANTRY CRANES**

Implementing the Integration Program will eliminate the direct operational interaction between the marine terminals and cargo owners, their representatives and the outside trucks that handle their cargo. The only customers that the marine terminal has to deal with are the shipping lines and ICDs. Unlike cargo owners, lines and ICDs are well familiar with port operations.

Eliminating dealing with consignees and shippers along with their outside trucks simplifies both yard and gate operations at the marine terminals. If all inbound boxes are destined to ICDs, a simple block storage system can be implemented in the yard. The preferred stacking system for block storage is based on reachstackers (RSs) or, perhaps, since no selectivity is required, much less expensive yard machines, top-loaders (straight mast forklifts with spreader attachment). In this case there is no need for expensive terminal operating system to keep track of box locations. RSs can also be employed for stacking export boxes, since the transfer of them to the terminal from the ICDs can be organized according to the desired stowage plan.

---

<sup>4</sup> Direct transfer from ships to off-dock yards was practiced in Port Limon, Costa Rica, resulting in low berth productivity. Direct transfer was considered mainly for ship-to-rail transfer. See: [www.asafashar.com](http://www.asafashar.com), On-Off Terminal Ship-to-Rail Transfer and the All-Rail Terminal, *Cargo Systems, 7th Terminal Operations Conference Papers*, June 1992, Genoa, Italy, pp. 101-106.

The transformation of the present yard system to block stowage could also eliminate the need for rubber-tired gantry cranes (RTGs), the main yard equipment at present marine terminals. RTGs' main advantage is their ability to select specific boxes from a stack (selectivity/shuffling). This selectivity is required in case of consignees coming to the marine terminal to claim specific boxes. However, RTGs cost about twice that of RSs and they are much less flexible (e.g., moving between stacks, having two machines working on the same stack, etc.). To further expedite the marine terminal / ICD transfer process, ICDs should be encouraged to use their own RSs at the marine terminal for loading and unloading their trucks. We understood that this already is the practice in Mombasa in several cases.

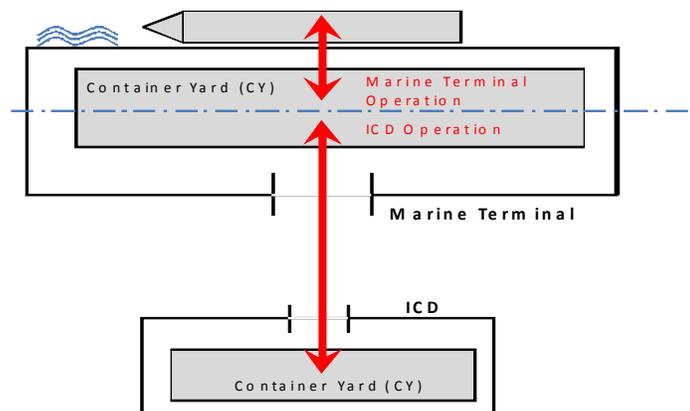
## DIVIDING THE MARINE TERMINAL INTO SHIP AND TRUCK SECTIONS

The Integration Program will result in de-facto segmentation of the marine terminal into two sections including:

- Berth Section, whereby ships are handled by the marine terminal's operator; and
- Gate Section, whereby trucks are handled by the ICDs.

Figure 7 below illustrates this segmentation.

Figure 7. Dividing the Operations of the Marine Terminal



Source: Nathan Associates Inc.

The segmentation results in a fundamental change of the operating system of the marine terminal. Ship handling under this segmentation is reduced to “dumping” the import boxes at one location in the container yard. The operation is under the total control of the marine terminal. There are no interruptions by outside trucks and there is no searching for yard space to stage boxes. The handling of export boxes should also be simple since most of it is empty boxes. With this radical simplification of the operating system, there is no reason why Dar es Salaam and Mombasa productivity would not match that of foreign ports.

It is also reasonable to expect that the productivity of truck handling and the entire transfer operation under the full control of the ICDs will significantly improve. As noted above, ICDs are complaining that marine terminals do not allocate sufficient yard equipment for their trucks and that boxes are not available immediately upon discharge. Both issues are resolved following the implementation of the Integration Program; boxes are not assigned specific location at the yard and yard equipment and truck handling is the responsibility of the ICDs. ICDs could create a “conveyor” system, dedicating RSs at the marine and their own container yards, shuttling their trucks back and forth between their RSs. An efficient transfer system could expedite the transfer of boxes, make them available faster and reduce the cost of transfer by eliminating truck waiting.

### **TRANSFORMATION OF THE MARINE GATE**

If ALL boxes are flowing to/from ICDs or empty depots, gate operations should also be greatly simplified. There is no need to scan and weigh boxes at the marine terminal under the Integrated ICDs system. The only document needed at the Marine gate is the discharge/load list. The gate process could be further simplified if Optical Characteristic Reader (OCR) or, better off, Radio Frequency Identification Device (RFID) tags are used. In this case no cargo-related document at all is required at the gate; the barrier will rise automatically if the RFID is read and cleared. The only document left is the Equipment Interchange Report (EIR). However, as is the case in other countries, an agreement can be reached between the marine terminal and ICDs to eliminate the need for EIRs, especially if the ICD representative at the stack can contact the marine terminal in case of damaged boxes and handle the paperwork there.

Following the implementation of the Integration Program, the marine terminal gate is transformed into *inter-terminal gate*; its previous functions are now transferred to the ICDs gates. To re-emphasize: No cargo or equipment processing should take place at the transformed marine terminal gate. The only function of the gate would be security, prohibiting the entry of unauthorized vehicles and individuals. The ICD’s trucks and drivers, both are equipped with electronic tags, should be able to cross the gate without any delay during all hours, day and night. If needed, the gate could also be equipped with security cameras.

### **IMPROVING ICDs ROAD CONNECTION TO THE PORT**

The road connection between ICDs and marine terminals is one of the most critical elements in the proposed Integration Program. The connecting roads are usually short, typically one to five km. These roads can be improved with little investments, including widening, installation of intelligent traffic lights (based on demand) and even strengthening the road beds to allow the transport of heavy boxes. The ICDs interviewed by us indicated their desire to undertake upon themselves the improvement of these roads. In fact, the construction of the new Interpel ICD in Mombasa included a major improvement of the access road. Our cursory observations of the port area did not identify major bridges; hence this strengthening is not expected to be costly.

To further enhance the integration and save on transportation cost we suggest to examine the possibility of allowing 2 x 40 feet trailers.<sup>5</sup> Likewise, it is reasonable to expect ICDs to invest in Mafi systems which are faster and more economical for short inter-terminal transport.

The Integration Program is expected to increase the traffic between the marine terminals and ICDs. However, it will also result in considerable reduction in congestion in the roads surrounding the port. Currently most of this congestion is caused by vehicles waiting for completion of cargo related processes and also all vehicles using one gate at the port to deliver or evacuate containers. With the Integration Program, this function of delivery and collection of boxes by customers will be performed at the ICDs, Consequently, instead of concentrating all the traffic at a *single gate* of the marine terminal, the traffic will be distributed over 5 - 10 gates of ICDs located in several areas around the port. Moreover, unlike the present, uncontrollable pattern of truck traffic, following the Integration Program the traffic will be planned and mostly conducted at night and by trucks specializing in this traffic.

Some of the ICDs already have a system of truck appointment. If truck appointment becomes part of the requirement of licensing ICDs (see below), there is no reason for congestion around ICDs.

### **EXTENDING SHIPPING LINES' LIABILITY**

The main premise in our proposed system of integrated ICDs is that they function as marine terminals with regards to cargo handling; the marine container yard is simply moving inward to the ICDs' container yard and the gate of the marine terminal is moving to the ICDs' gates. Accordingly, shipping lines should note in their Bill of Ladings the ICDs as the point of delivery for imports and receipt for exports. Put differently, the liner term that lines quote to their customers will extend from the gate of the marine terminal to that of the ICD. This notification assigns the liability of transferring boxes from the marine container yard to the ICD container yard to the lines. At present, the responsibility for the transfer is unclear. Since the port authorities nominate the ICDs and instruct the lines to transfer their boxes to them, the port authorities bear some liability. In fact, presently, the port authorities treat the ICDs as if they are part of the public port which happens to be located outside the public facilities. The legal issues should be reviewed prior to implementation of the program.

### **SHIPPING LINES CONTRACTING WITH ICDs**

In most countries, ports have several marine terminals for shipping lines to select from. Usually, the selection process includes an annual bid in which the various terminals quote their prices and performance level. Normally, higher performance (e.g., berth productivity, convenient berthing windows, etc.) fetches higher prices. A similar system of ICD selection is proposed for Dar es Salaam and Mombasa. Our short study revealed that in each port there was sufficient number of ICDs to assure a competitive setting. The competition among ICDs, in turn, will assure high level of performance and lower prices to lines and their customers, shippers and consignees.

---

<sup>5</sup> Multi-trailer systems of three and even five 40-ft trailers have been in use for several years in European ports.

We are well aware that ICDs vary widely in the size of facilities, quality of service and location. Moreover, some of the present ICDs are too small to contract with large shipping lines. It is reasonable to assume that the smaller ICDs will contract with smaller shipping lines and vice versa. Alternatively, as is the case in many markets, the smaller ICDs will be forced to join forces to create a larger and more competitive ICD.

The long-term contracting between lines and ICDs has advantages to both parties. The lines could modify their contracts according to their specific needs. For example, they may insist on low storage rates if their main customers (consignees) see it as essential; they may require that the ICD also provides storage of empty boxes; they may require servicing of reefer boxes; they may even require that their documentation offices will be there (single window for line and terminal processing), etc.

Having long-term contracts with shipping lines would allow ICDs to better plan their facilities and equipment along with respective investments. It will also facilitate financing of additional facilities.

## **LICENSING AND REGULATION OF ICDs**

The ICDs visited by our team, both in Dar es Salaam (TRH and Azam) and Mombasa (MCT and Interpel), portrayed well-kept facilities and providing high level of service. Nevertheless, since the Integration Program assigns to ICDs a much larger role than present, we suggest that the Integration Program will also include a system of licensing and regulating ICDs. The requirement for obtaining license should include location in terms of distance and access roads, overall size of facilities, availability of pre-gate parking for trucks,<sup>6</sup> handling equipment and trucks, proper EDI system, adequate offices for Custom, Port Authority and drivers, security, etc.

The regulation should be related to the service level, including periodical filing of data regarding truck turnaround times, damages to cargo and trucks, promptness in transferring boxes from the marine terminals and others.

During the study, there was a strong concern that because of a record weak regulation and enforcement, it would be dangerous to assume that the proposed system would work. As a result the system could end up being implemented based on opportunistic rather than professional and economic efficiency principles. However, in our proposal it will not only be regulation that drives implementation of the program. As explained above the additional strong factor will be the shipping lines contracting ICDs competitively, based on price and performance levels. This competition will force of ICDs to ensure that they operate professionally and at high levels of efficiency. Regulation will, therefore, help to set rules under which such competition can take place.

---

<sup>6</sup> For example, the new INTERPEL facility in Mombasa includes 30 pre-gate parking slots.

## **CHANGING THE ROLE OF THE PORT AND ICDs**

Presently, the ICDs handle about 60 percent of the import cargo. Hence, adding the handling of the remaining 40 percent along with the small export does not seem a major change. While not apparent at the first glance, the complete removal of cargo activities from the marine terminal to ICDs radically changes the role of the port and ICDs. Under the Integrated ICDs concept, the marine terminal is transformed into a ship handling facility, with all the rest of the activities transferred to the ICDs. Hence, the ICDs become “branches” of the marine terminals. Put differently, the port and the ICDs are transformed into a comprehensive “greater port” system.

## **PARTIAL IMPLEMENTATION**

The removal of all import boxes advocated by the Integration Program might appear too costly for importers presently claiming their cargo directly at the marine terminals. Partial implementation, or allowing some of the boxes to be claimed at the marine terminals, requires the container yard to retain its capability for single-box selectivity. It also requires that the container yard continue to serve outside trucks. Processing these trucks at the gate requires scanning, inspection, creating EIRs, etc. Hence, although the number of trucks at the marine terminals under partial implementation would be smaller than at the present, having even a small number of trucks nullifies the main thrust of the Integration Program: clearing the marine terminal from ALL outside trucks and cargo activities and simplifying ship handling in order to radically increase berth productivity.

Presumably, the Program may increase costs for efficient importers who presently process their cargo promptly and claim it directly from the marine terminals. However, we believe that if the Program is properly implemented, even these importers will enjoy lower costs. According to our interviews, the present truck turnaround time at the port ranges four to eight hours, compared to less than one hour in efficient private ICDs.

## **Costs and Savings of Integrated ICDs System**

### **ICD'S TRANSFER VS. SHIP'S DELAY**

No proper analysis of costs and savings has been prepared at this conceptual stage of our study. Nevertheless, based on our interviews, we estimate that the additional cost involved with ICDs includes an average of \$50/TEU for transport and \$20/TEU for the 2 lifts, or a total of \$70/TEU. This additional cost is much smaller than the congestion surcharge imposed by shipping lines which, according information provided, amounted to \$300/TEU in 2006. In addition, truck turnaround time in the ICDs interviewed is less than one hour compared to at least four hours at the marine terminals. Assuming the equivalent cost of truck hour at \$25/hour and 1.5 TEUs/box, this saving is worth \$50/TEU ( $3 \times 25/1.5$ ).

Following the introduction of the ICD/CFS program in 2007 along with the recession, ship waiting in Dar es Salaam and Mombasa has been reduced, but not eliminated. During the period of our study, in both ports there were containerships on anchor waiting for berth, although there were no congestion surcharges. However, the situation can change quickly once trade and traffic revamp their growth.

## **MARKET INSTEAD OF PUNITIVE RATES**

In the present storage tariff, the rate “jumps” from \$0 for the 5<sup>th</sup> day to \$120/TEU for the 6<sup>th</sup> (\$20 for storage and \$100 for re-marshalling). This rate structure does not reflect costs; it is based on punitive charges intended to relieve the severe shortage in yard space at the marine terminals.

No such shortage in yard space is expected once the Integrate ICDs system implemented. In this system, boxes are stored for a very short period in the marine terminal, ideally for only a few hours, and then transferred to private ICDs, which have plenty of space. There is no “science” in determining the five day free time; it does not necessarily reflect the commercial needs of importers and exporters. In some cases, usually when the cargo is sent collect, or the freight is paid locally, or there are problems in documentation, there is an objective need for a longer dwell time -- which is not a reason for punishment. Moreover, if there is no shortage in space, some importers and exporters may prefer to keep their cargo inside boxes and bear the real cost for it (storage and demurrage).

It is reasonable to expect that when shipping lines negotiate their own contracts with ICDs, the storage rates in these contracts will better reflect both the ICDs’ costs and the requirements of importers and exporters. For example, the main costs of ICDs, in case of import boxes, include: transport from the marine container yard, truck handling at the marine and ICD container yard, and gate processing. These costs have nothing to do with the length of storage. Accordingly, the ICD contract rates could be a fixed cost per box of, say, \$50/box, for transport, handling and processing, plus \$5/TEU-day storage. The storage rate is similar in nature to box demurrage. Most lines presently allow 14 days free time, charging \$5/day beyond this period. Generally, rates should be the result of free negotiations between ICDs and shipping lines and not part of a uniform tariff set by the port authorities. The lines, in turn, will incorporate these rates in their ocean freight. Desirably, the rates will be clearly presented as add-on tariff items to show transparency. The importers and exporters are first and foremost the customers of shipping lines. It is reasonable to assume that lines will make sure that their customers enjoy good services and reasonable rates at the ICDs they contract with.

## **The Impact of Integrated ICDs on Capacity of Marine Terminals**

### **CAPACITY CALCULATION METHODOLOGY**

The common methodology for calculating capacity of container terminals is based on separately calculating the capacities of each of the terminals’ main components: berth, yard and gate. The capacity of the terminal is determined by the most restricted component (“bottleneck”).

In most terminals, the yard is the most restricting component and therefore determines the overall terminal capacity. Put differently, in most terminals the berth has much larger capacity than the yard. This is also the case in the container terminals of the ports of Dar es Salaam and Mombasa. These terminals, as already noted in previous sections, are narrow and with relatively small yards.

## YARD CAPACITY CALCULATION

Yard capacity is a function of two factors: the static (holding) capacity, measured in TEUs, and the dwell time, or the time containers stay at the yard. The capacity calculation formula in its simplest form is:

$$\text{Yard Capacity (TEUs/Year)} = \text{Available Yard Slots (TEUs)} \times 365 / \text{Average Dwell Time (Days)}$$

The parameters in the above formula are usually modified to reflect local conditions: (a) Available slots are reduced in the case of high-stacking yard system to account for empty slots required to prevent excessive “shuffling” (e.g., using three high in the case of one over four RTG system); and (b) Average dwell time is increased to account for peak situations. A more advanced formula breaks down the number of slots according to types of boxes, since each requires different stacking system (e.g., six high block storage for empties). The dwell time is also differentiated according to the type of boxes, since each has different characteristics (e.g., import boxes have much longer dwell time than exports). A much more advanced calculation methodology employs a stock & flow simulation to capture the dynamics of the yard inventory and better reflect peaking situations.

## Berth Capacity Calculation

Berth capacity is a function of berth productivity and the time that the berth operates at this level of productivity. This time is also measured as a percentage of available (calendar) days and therefore defined as berth utilization. Berth productivity, in turn, is a function of crane productivity and the number of cranes available at the berth. The simplest formula used for calculating berth capacity is:

$$\text{Berth Capacity (TEUs/Year)} = \text{Crane Productivity (Moves/Hour)} \times \text{TEU Ratio (TEUs/Move)} \times \text{Average Number of Cranes} \times \text{Available Time (Hours/Year)}$$

Terminal capacity is simply the product of berth capacity multiplied by the number of berths. The available time in the above formula is a function of allowed berth utilization. Higher utilization usually results in longer ships’ waiting. A more advanced capacity calculation methodology applies a queuing simulation with the capacity is defined by the allowed waiting time of ships.<sup>7</sup>

## MASTERPLANS’ YARD-BASED CAPACITIES

The masterplans reviewed for this short study used yard capacity to determine terminal capacity of the two ports. The implicit assumption, which we agree with, is that at the present layout and operating system, yard capacity is considerably smaller than berth capacity. The masterplans employed linear capacity calculation formulas similar to the one presented above. As seen in this formula, the capacity is very sensitive to assumptions on the average dwell time. For example, in Mombasa’s masterplan study, the average dwell time

---

<sup>7</sup> For example, in San Antonio, the capacity was determined assuming: (a) average waiting time of ships will not exceed one hour; and (b) less than 10 percent of the ships will wait four or more hours for berth.

at the marine terminal (Berth 16-18) is assumed 12.1 days for capacity calculation purpose.<sup>8</sup> Hence, reduction in dwell time to, say, 5.9 days (see Figure 2), will result in doubling yard capacity.

## BERTH CAPACITY INDICATORS

Calculating terminal capacity based on yard capacity as suggested by the ports' masterplans is plausible under current circumstances—but not if the system of Integrated ICDs is fully implemented. In the proposed system of Integrated ICDs, the marine terminal yard serves only as a temporary buffer, for which there is plenty of space in existing terminals. Therefore, the marine terminal yards will not constrain terminal capacity. Likewise, the yard capacity of ICDs is large and also will not constrain terminal capacity. The capacity of the container terminals working with Integrated ICDs will be determined by berth capacity which, as noted above, is much larger than yard capacity.

Conducting a detailed calculation of berth capacity of the specialized and conventional terminals of Dar es Salaam and Mombasa is beyond the scope of this short diagnostic study. However, for illustration, we included here a rough estimation of these capacities. The estimation is based on a system of berth capacity indicators developed based on data collected and analyzed from a sample of ports worldwide. The indicators have been used in several masterplan studies, including national port plans.

Table 1. Berth Capacity Indicators

Year	Type of Berth	Berth Length (m)	Depth Alongside	Berths per Terminal	Design Ship (TEUs)	Berth Capacity (TEUs/Berth)	Berth-m Capacity (TEUs/m)
2009	Sub Panamax	250	12	3	3,000	350,000	1,400
2012	Panamax	280	14	3	4,500	450,000	1,607
2012	Panamax	280	14	4	4,500	495,000	1,768
2014	Post Panamax I	300	15	3	5,700	500,000	1,667
2014	Post Panamax I	300	15	4	5,700	550,000	1,833
2017	Post Panamax II	350	16	4	8,000	700,000	2,000
2025	Post Panamax III	400	16-18	4	12,000	1,000,000	2,500
2009	Multipurpose	150	10-11	2	1,000	100,000	667

Source: Nathan Associates Inc.

Table 1 presents a series of berth capacity indicators categorized by ship size (capacity in TEUs). The Table also presents berth specifications (length and depth alongside). The berth capacity varies according to the number of berths which, in turn, determined the allowed berth utilization. The figure was taken from a national masterplan study and therefore includes, in the first column, the year that each type of ship is expected to be deployed.

<sup>8</sup> The appendix to the masterplan also presents a series of capacity calculations based on berth capacity.

For the purpose of estimating capacity of Dar es Salaam and Mombasa container ports, we assume, based on the above Table that capacities of berths in the existing terminals are:

- Specialized Container Terminals – 250,000 TEUs/berth
- Conventional Container Terminal – 150,000 TEUs/berth

The above capacities are based on the first and last lines of Table 1, with adjustments for ship size.

Before applying the berth capacity indicators a clarification should be made here. The above berth capacity indicators are based on the performance of worldwide terminals where there is sufficient shore and yard equipment along with motivated labor resulting in much higher berth productivities than in Dar es Salaam and Mombasa. For example, it can be shown that at 70 percent berth utilization, achieving 250,000 TEUs/berth for a specialized terminal requires average berth productivity of about 40 moves/berth-hour. This productivity is based on working an average of two STS gantry cranes each at about 20 moves/crane-hour. Likewise, in the case of conventional terminal, the required berth productivity of 24 moves/berth-hour or, assuming two mobile harbor cranes per berth, amounts to 12 moves/crane-hour.

### **BERTH CAPACITY OF DAR ES SALAAM WITH INTEGRATED ICDS**

Dar es Salaam's specialized terminal, Berths 8-11, has three full berths. Our estimation of this terminal's capacity, when fully developed and equipped with sufficient handling equipment, is 750,000 TEUs (3 x 250,000). For comparison, the capacity estimate included in the masterplan is 500,000 TEUs under similar conditions. The capacity estimate of the masterplan for the new terminal at Berth 13-14, with two berths, is 700,000 TEUs. Accordingly, the masterplan's implicit assumptions for berth capacity indicators are, for Berths 8-11 166,000 TEUs/berth (500,000/3) and for the new terminal 350,000 TEUs/berth (700,000/2).

Dar es Salaam's conventional terminal, Berths 5-7, has two full berths. Our estimation of this terminal's capacity is 300,000 TEUs (2 x 150,000). The underlying assumption is that the terminal will be mainly serving containerships, using modern mobile harbor cranes. This, in turn, requires that the transit sheds at this terminal are demolished and turned into open yards for accommodating container stacks. Another requirement is that there would be no obstruction at the berth such as the proposed gallery for elevated conveyor and unloaders. Detailed calculation of the berthing requirement of the non-containerized cargoes was not conducted at this point. However, preliminarily, it seems that if no bagging alongside ships is allowed along with mandatory usage of mobile harbor cranes for certain cargoes, the conventional terminal can accommodate the remaining non-containerized cargo.

### **BERTH CAPACITY OF MOMBASA WITH INTEGRATED ICDS**

Mombasa's specialized terminal, Berths 16-18, will have three full berths after extending Berth 18. Its capacity will be 750,000 TEUs (3 x 250,000). In comparison, the new Kipevu West terminal at Berths 20-21 will have two berths and capacity of 1.2 million TEUs or 600,000 TEUs/berth (1,200,000/2).

Mombasa's conventional terminal, Berths 11-14, will have four full berths after extending Berth 14. Its capacity will be 600,000 TEUs (4 x 150,000). The assumption here is that this terminal will mostly serve container ships with modern mobile harbor cranes. Table 2 presents a summary of the above calculations. As seen in there, the total berth capacity of Dar es Salaam's container terminals is 1.05 million TEUs and that of Mombasa 1.35 million TEUs.

Table 2. Berth Capacity Indicators for Dar es Salaam and Mombasa Ports

Type	Location	Number of Berths	Berth Capacity	Terminal Capacity (TEUs)
<b><u>Dar es Salaam</u></b>				
Specialized	Berths 8-11	3	250,000	750,000
Conventional	Berths 6-7	2	150,000	300,000
Total				1,050,000
<b><u>Mombasa</u></b>				
Specialized	Berths 16-18	3	250,000	750,000
Conventional	Berths 11-14	4	150,000	600,000
Total				1,350,000

Source: Nathan Associates Inc.

Table 3. Berth Capacity vs. Throughput for Dar es Salaam and Mombasa Ports

Port	Throughput (TEUs)	Terminal Capacity (TEUs)	Capacity/Throughput	Years to Capacity (8% Compounded)
Dar es Salaam	360,000	1,050,000	2.92	13.91
Mombasa	730,000	1,350,000	1.85	7.99

Source: Nathan Associates Inc.

Table 3 presents a comparison between the above capacities and present throughputs. As seen there, Dar es Salaam's capacity is almost three times its throughput while Mombasa's capacity is almost twice its throughput. This Table also includes calculations of the number of years until the throughputs of these ports reach their capacities, assuming eight percent compounded annual growth: Dar es Salaam has almost 14 years and Mombasa 8 years. These capacity figures are indicative. More accurate assessment of terminal capacity following the implementation of the Integration Program requires a much more in-depth study.

Nevertheless, even at this level of study we can conclude that if these ports implement the proposed Integration Program, along with installation of additional shore cranes, training of labor and providing them with motivation, the present container terminals have sufficient capacity to handle the growth in traffic in the next 5 years. During this time, these ports should be able to develop new and larger terminals, capable of handling future, larger ships. The future container terminals should have width of 400-500 m, providing for large container yards that do not require substitution by ICDs.

## **BERTHING WINDOWS**

None of the terminals is currently working with berthing windows, although we understood that Dar es Salaam may soon implement the system for one or two shipping lines. Implementing a system of berthing windows requires that the ports have sufficient capacity so all lines could participate in it – which is not the case at the present. Implementing the Integration Program, as demonstrated above, can substantially increase terminal capacity allowing for implementing the berthing windows system for all shipping lines. A wide implementation of a system of berthing windows will reduce ship waiting times and the respective cost of shipping.

## **INVESTMENTS IN ICDS**

In properly-designed marine terminals with large container yards there is no need for ICDS; import and export boxes complete their delivery and release processes at the marine terminals. This may be the case at future terminals in Bagamoyo in the case of Dar es Salaam and West Kipevu in Mombasa. Still, according to these ports' masterplans, even when the new terminals are in operation, the existing terminals, with narrow yards and limited space, will continue to be fully utilized, handling about half of the throughput. Hence, the system of Integrated ICDS is not going to disappear in the near future; it will continue for the long term in order to ensure high levels of productivity at the existing terminals.

Implementing the proposed Integration Program will result in almost doubling the traffic handled by ICDS. Based on our interviews, it seems that the present ICDS may have sufficient capacity to handle the additional traffic. Nevertheless, as traffic increases, additional ICDS capacity and the respective investments in facilities and equipment by the private sector will be required. These investments are relatively small especially when compared to those in marine terminals. We understood that construction of a large ICDS requires investments of about \$5 million, excluding the cost of land (which can be leased). In order to recover these investments, investors should have assurance that the rules and regulations governing ICDS are not going to change in the near future.

The punitive tariff of present ICDS, hinders their ability to develop additional, value-added services (such as stuffing and stripping of containers, packing, etc) at their facilities since cargo owners attempt to remove their cargo as soon as possible to avoid the high storage rates. Modifying the tariff, as discussed in Section entitled "Market instead of Punitive Rates" above, would allow the development of such services to the mutual benefits of ICDS owners and their customers.

## **COMPETITION BETWEEN SPECIALIZED AND CONVENTIONAL TERMINALS**

The Ports of Dar es Salaam and Mombasa have two container terminals each, one specialized and the other conventional. A specialized terminal has a substantial operational advantage over a conventional one since gantry cranes are about twice as fast as mobile cranes. The conventional terminal, using mobile harbor crane, has advantage in handling smaller ships because of the wider reach of these cranes that can cover almost the

entire ship without moving the crane as would be required by a gantry crane. Likewise, the investments in a conventional terminals are about half that of a specialized terminal.

The majority of the ships handled in Dar es Salaam and Mombasa are relatively small and, therefore, could be handled by both terminals, although the overall productivity of the conventional terminal will be lower. Hence, despite the differences between these terminals, they could compete with each other especially on smaller ships. The conventional terminals could compensate for the lower productivity by charging lower tariffs. The Port of Lagos has a similar setting with one specialized and two conventional terminals, all of which are private and highly competitive.

The power of terminal competition can also be demonstrated in Dar es Salaam. Following the privatization program in 2000, Dar es Salaam's specialized terminal has been managed by a private operator while the conventional terminal is still operated by TPA. Still, during interviews we learnt that although they have the same tariff, there is competition between them, with lines switching their ships between them. This competition is already driving the terminals to improve their performance. This competition could be much enhanced if the conventional terminals were also privatized.

Mombasa also has a similar setting, with two container terminals, one specialized and the other conventional, with overlapping capabilities that could ensure competition. We therefore propose to reconsider and expand the privatization program to include two competing terminals at each port.

## **INTERMODAL TERMINALS**

It seems that transit cargoes are likely to be the main source of future growth, with most of the transit boxes moving by rail. Presently, the only intermodal rail yards for loading/unloading wagons with containers are available inside the marine terminals. These yards, especially Dar es Salaam's yard, seem to be limited in size and capacity. No in-depth analysis of the capacity of intermodal rail yards was conducted in this short study. Still, based on experience from other ports, it seems that these yards will not be able to cope with future demands once the rail services operate at full capacity.

As noted several times throughout this report, the existing marine terminals of Dar es Salaam and Mombasa are narrow, with relatively small yards. The rail facilities, including working and switching tracks and near-track storage, occupy a sizeable portion of these terminals that otherwise could be functioning as container yards. In addition, transit cargoes tend to have long dwell time and therefore will consume a sizable portion of the existing container yards.

In line with the concept of Integrated ICDs of removing truck handling activities from the marine terminals, we propose that the intermodal activity also will be relocated outside the marine terminals. We understood that this issue is under study presently.

## 4. Implementation of the Integrated ICD Concept

### Decision to Continue with the Program

The Program was already presented and discussed in a preliminary fashion with port authorities (TPA and KPA), revenue and regulatory authorities (SUMATRA, KMA), shipping lines and ICDs. The Program also was discussed in two workshops in Dar es Salaam and Mombasa. But, we have not met with KRA and other stakeholders especially shippers and consignees.

The response by all parties so far was positive with a firm recommendation to adopt the concept for implementation. However, all the discussions with stakeholders were for consultation and validation only; no decision was made on whether or not the concept should be developed to implementation. Accordingly, the next step is to send this report to all stakeholders and motivate the relevant decision makers to adopt the concept and initiate its further development and implementation.

### Detailed Assessments of Program Issues

The proposed Program to integrate ICDs with marine terminals appears simple. In fact, it has already been implemented on a partial basis. The simple appearance of the system is misleading; the Program radically changes the port system. Hence, prior to any attempt to implement the Program it is necessary to further analyze and establish implementation challenges and respective solutions on several issues on which the Program could have far-reaching impact.

The issues that require more detailed assessment include:

- Costs and benefits involved with the Program
- Ship-handling productivity, dwell time of boxes and turnaround time of trucks
- Ship-handling and yard equipment in the marine terminals

- Incentive pay system for ship-handling labor
- Tariff system and costs in the Integrated ICDs system
- Custom procedures especially regarding transit cargo
- Gate procedures including electronic tagging of ICD equipment
- Capacity of present and new ICDs
- Licensing and regulating ICDs
- Liability during transfer between ports and ICDs following the implementation of the Program

## **Small Scale Experiment**

Before fully implementing this Program and as part of the above studies, it is suggested to conduct a small scale experiment involving one ICD and one shipping line at each port. The intention in this experiment is mainly to explore the operational aspects such as transfer rate, block operation, gate system, private equipment working inside the port, etc.

## 5. Summary

The overall objective of the proposed Integration Program of ICDs is to radically increase berth productivity and capacity of Dar es Salaam and Mombasa. We use the term radically to indicate that based on this short diagnostic study, we believe that both the productivity and capacity can be increased by 50-100percent if not more. The radical change in productivity requires a radical change in the port system. This change involves moving the entire terminal handling, including the handling of outside trucks and dealing with clearing agents, Customs, port authorities and the related, to off-dock ICDs, serving as substitute for the marine terminals' container yards and gates. This shifting of the cargo activity to ICDs will significantly simplify the remaining operations at the marine terminals, allowing them to concentrate on ship handling. This, along with the installation of additional equipment and motivation of labor, is expected to result in radical increase berth productivity.

Marine container yards are considered the constraining factor of the capacity of marine terminals. The Integration Program substitutes the small marine container yards with the much larger ICDs' container yards, relieving this constraint and providing for substantial increase in the marine terminals' capacity. Put differently, the Program allows the marine terminals to fully utilize their most scarce and expensive resource - the berthage.

The proposed integration is mainly an institutional/organizational measure; it only requires limited investments by the port authorities. Likewise, it does not require major investments by the private sectors especially the ICDs. Nevertheless, if needed, the existing ICDs can be expanded and new ones constructed at relatively limited investment costs.

Gaining capacity by better utilizing existing terminals is by far less costly than developing new terminals, as described by the present masterplans of these ports. Also, unlike the ports capacity enhancement projects in masterplans that are geared toward the long-term, integrating and expanding ICDs can be achieved within a short time. However, implementing the Integration Program should not delay the development of new terminals since these terminals are designed for handling future larger ships. Our Program intends to provide Dar es Salaam and Mombasa with the opportunity to avert a short-term possible catastrophe in port congestion until the new terminals are ready.

The proposed Integration Program changes the roles of the ports and ICDs. The Program calls for differentiation and specialization in the port system; the marine terminals should focus on handling ships; the ICDs on handling cargoes. We believe that this redefinition of roles, that some may consider as extreme and costly, is unavoidable. The consequences of not implementing the Program may be dire: continued low productivity is certain to result in congested marine terminals, long waiting lines of ships and trucks and dramatic increase in the cost of transportation up to a crisis level. The port crisis experienced in Dar es Salaam and Mombasa in 2006 was the cause for the conception of ICDs. Preventing the recurrence of a crisis requires the integration of these ICDs with the marine terminals, redefining the port system of Tanzania and Kenya.



# Appendix A. Persons Interviewed

Organization	Contact Information
Tanzania Port Authority	J. R. Ngokota Operations Manager (GC) Tel: +(255) 222138590 Cell: +(255) 784390665 Email: <a href="mailto:ngokota@hotmail.com">ngokota@hotmail.com</a>
PIL (Tanzania) Limited	D. Suresh Kumar Deputy General Manager Tel: +(255) 222127801 Cell: +(255) 784769545 Email: <a href="mailto:suresh@dar.pilship.com">suresh@dar.pilship.com</a>
Inchcape (Tanzania) Shipping Services	Dharma Subasinghe General Manager Tel: +(255) 222150416/2151038/2150521 Cell: +(255) 784324207 Email: <a href="mailto:dharma.subasinghe@iss-shipping.com">dharma.subasinghe@iss-shipping.com</a>
Nyota (Tanzania) Ltd.	Charles Moret Managing Director Tel: +(255) 222120479/98 Cell: +(255) 757677776 Email: <a href="mailto:tanlinmng@nyota.co.tz">tanlinmng@nyota.co.tz</a>
Emirates (Tanzania) Shipping Line	Nirjhar S. Bhaduri General Manager Tel: +(255) 222126740/41/42 Cell: +(255) 786655511 Email: <a href="mailto:nirjhar@esltanzania.com">nirjhar@esltanzania.com</a>
Maersk (Tanzania) Line	Jamal Mangush Operations Manager Tel: +(255) 222120014 Cell: +(255) 767299929 Email: <a href="mailto:tanopsmng@nyota.co.tz">tanopsmng@nyota.co.tz</a>

Organization	Contact Information
Tanzania International Container Terminal Services Limited (TICTS)	Donald H. Talawa Terminal Manager Tel: +(255) 222134056/7/8 Cell: +(255) 754286866 Email: <a href="mailto:dtlawa@ticts.com">dtlawa@ticts.com</a>
Tanzania Shipping Agents Association (TASAA)	Emanuel B. Mallya Chairman Tel: +(255) 222121097 Cell: +(255) 784326122/713326122 Email: <a href="mailto:mallya@tz.stacot.com">mallya@tz.stacot.com</a>  Peter Kirigiri Honorary Secretary Tel: +(255) 222137161 Cell: +(255) 766880088 Email: <a href="mailto:dar.pkirigini@delmas.com">dar.pkirigini@delmas.com</a>
Tanzania Shipping Agency	Anil Patel Manager Director Tel: +(255) 222850670 Email: <a href="mailto:anil@tsal.co.tz">anil@tsal.co.tz</a>
ZIM (Tanzania) Limited	Emanuel B. Mallya Managing Director Tel: +(255) 222114859/2124011/2125220 Cell: +(255) 784326122/713326122 Email: <a href="mailto:mallya@tz.stacot.com">mallya@tz.stacot.com</a> <a href="mailto:Mallya.emmanuel@tz.zim.com">Mallya.emmanuel@tz.zim.com</a>
Oceanair Freight Ltd.	Ally Kirro Export Operation Manager Tel: +(255) 222133666/2115260/1 Cell: +(255) 754844747 Email: <a href="mailto:operation.icd@trntz.com">operation.icd@trntz.com</a>

Organization	Contact Information
Kenya Maritime Authority	<p>Tumaini Namoya Tel: +(254) 412318398/9 Cell: +(254) 722771429 Email: <a href="mailto:tnamoya@maritimeauthority.co.ke">tnamoya@maritimeauthority.co.ke</a></p> <p>John Omingo Commercial Shipping Manager Tel: +(254) 412318398/9 Cell: +(254) 721738625 Email: <a href="mailto:jomingo@maritimeauthority.co.ke">jomingo@maritimeauthority.co.ke</a> <a href="mailto:omijod@yahoo.com">omijod@yahoo.com</a></p>
CMA CGM Delmas	<p>Sreeni Ram Prabhu Managing Director Tel: +(254) 413435262 Cell: +(254) 736919633 Email: <a href="mailto:mob.sprabhu@cma-cgm.com">mob.sprabhu@cma-cgm.com</a></p>
PIL (Kenya) Limited	<p>Bhasskar J. Modi Manager Director Tel: +(254) 412221022 Cell: +(254) 711665411 Email: <a href="mailto:bhasskar.modi@mba.pilship.com">bhasskar.modi@mba.pilship.com</a></p>
Inchcape (Kenya) Shipping Services	<p>David Mackay Vice President -East Africa Tel: +(254) 412314245/6 Cell: +(254)722787697 Email: <a href="mailto:david.mackay@iss-shipping.com">david.mackay@iss-shipping.com</a></p> <p>Caroli V. Odera Operations Manager Tel: +(254) 412314245/6 Cell: +(254) 722105079 Email: <a href="mailto:cv.odera@iss-shipping.com">cv.odera@iss-shipping.com</a></p>
Emirates (Kenya) Shipping Line	<p>Niroshan Jayasinghe Assistant General Manager Tel: +(254) 412319071/72/73/74 Cell: +(254) 738535485 Email: <a href="mailto:niroshan@eslkenya.com">niroshan@eslkenya.com</a></p>

Organization	Contact Information
Maersk (Kenya) Line	<p>Rolf Nielsen  Manager Director  Tel: +(254) 20828910/1/2/3/4/5/6  Email: <a href="mailto:kenlintop@maersk.com">kenlintop@maersk.com</a></p> <p>Jim A. Siro  General Manager, Operations Kenya Cluster  Tel: +(254) 412221273  Email: <a href="mailto:kenopsmng@maersk.com">kenopsmng@maersk.com</a></p>
Kenya Port Authority CFS	<p>Edward Opiyo,  Depot Manager  Tel: +(254) 0572028054  Cell: +(254) 726828401</p>
ZIM (Kenya) Limited	<p>Michael Inyasi  Tel: +(254) 412229226/2222044  Cell: +(254) 736412166  Email: <a href="mailto:inyasi.mike@ke.zim.com">inyasi.mike@ke.zim.com</a></p>
SDV (Kenya) Transami	<p>Jean-Christophe Tranchepain  Managing Director  Tel: +(254) 206421201  Cell: +(254) 733333320  Email: <a href="mailto:jean-christophe.tranchepain@bollore.com">jean-christophe.tranchepain@bollore.com</a></p>
Inchcape (South Africa) Shipping Services	<p>Ashley Cage  Regional Operations Manager Africa  Tel: +(27) 215518599  Cell: +(27) 795133476  Email: <a href="mailto:ashley.cage@iss-shipping.com">ashley.cage@iss-shipping.com</a></p>
Port of Bujumbura	<p>Melchior Barantandikiye  Director International Transport Department  Tel: +(257) 77757755</p>
Port of Kigoma	<p>Hebel Mhanga  Kigoma Port Master, TPA  Tel: +(255) 282802275, +(255) 7547 394 040  <a href="mailto:hmnanga@tanzaniaports.com">hmnanga@tanzaniaports.com</a></p>
Port of Mwanza	<p>Robbin M Maseke,  Senior Operations Officer, TPA  Tel: + (255) 262503074, +(255) 754830295  <a href="mailto:pmmwanza@tanzaniaports.com">pmmwanza@tanzaniaports.com</a></p>

Organization	Contact Information
Port of Kisumu	Eng. Benjamin Nzive Port Manager Kenya Railways Tel: +(254) 0202215796 Cell: +(254) 722 416308 <a href="mailto:bmnzive-1@yahoo.com">bmnzive-1@yahoo.com</a>



# Appendix B. Stakeholders' Roundtable Meetings on Integrated ICDs

## Introduction

This appendix summarizes the record of special stakeholders' roundtable meetings held in Mombasa and Dar es Salaam to review preliminary recommendations of Corridor Diagnostic Study (CDS) to integrate ICDs/CFSs with ports. The meetings in Dar es Salaam were held on October 1<sup>st</sup> and on October 4<sup>th</sup>, 2010 with the management and staff of the Dar es Salaam port. The meeting in Mombasa was held on October 5<sup>th</sup>. The participant lists of the meetings are presented in Table B1 through Table B3 at the end of this appendix.

The meetings started with a presentation by the CDS expert on ports and maritime transport about the preliminary findings and the main recommendation of CDS on Integrated ICDs. This was then followed with general discussions and deciding on takeaways and recommendations of the meeting.

## Presentation and Discussion

### PRESENTATION

The presentation by the ports expert contextualized the recommendation by reviewing the situation and development plans of the Dar es Salaam and Mombasa ports. The development plans listed structural (physical) measures that these ports intend to undertake to relieve congestion and provide additional container handling capacity. Although some of the plans included were termed as short-term, it is quite unlikely that a major boost to capacity will be available in less than three to five years. Since the terminals are already operating at full capacity or more, it is clear that without capacity enhancement there is a serious danger of the terminals going through another round of disaster of debilitating congestion, probably worse than the previous experience.

The presentation on the proposed ICD Integration Program elaborated the main thrust being relocating all cargo activities from the marine terminals to ICDs, including all the handling of outside trucks. This "cleaning" of the marine terminals requires the integration of the ICDs with marine terminals. This integration means that the ICDs' yards substitute the marine container yards (CYs) and the ICDs gates substitute the

marine terminals' gate. Since the combined ICDs container yards are much larger than the marine terminals' container yards, the Integration Program increases the overall capacity of container yards in the port system, which determines the overall capacity of Dar es Salaam and Mombasa for handling containers.

Furthermore, the "cleaning" of the marine terminal will result in significant simplification of ship handling operations, which are expected to substantially increase berth productivity and, hence port container handling capacity. The proposed Integration Program mainly relates to institutional/operational measures; it does not require investments in new port facilities and, therefore can be implemented in a relatively short period which can be in months.

Since most issues were common to both Mombasa and Dar es Salaam ports, the following section does not separate the discussions of common issues at the meetings. However, conclusions and recommendations have been reported separately for Mombasa and Dar es Salaam ports.

## DISCUSSION ON COMMON ISSUES

The main thrust of the discussions was on seeking clarification and addressing various concerns and implementation challenges that were raised. The clarification provided is summarized below but the revised report provides more elaborate discussion on the issues raised. The main arguments made during the roundtable meetings are:

- **Need to proceed with development of new terminals:** There was a concern that the proposal might imply postponing implementation of projects to build new container terminals or expand capacity. It was clarified that the projects should proceed and the proposal is meant to provide capacity to avert possible severe congestion while waiting for completion of the program to develop new capacity.
- **Need to address the problem of low off-take capacity by inland transport:** The low capacity to offload cargo from the port, particularly for rail, has a major impact on port performance and capacity. There is need to revive and develop this capacity. This is important because even the containers transferred to the ICDs will need to be offloaded in a short amount of time. However, this does not affect the need to resolve the problem of limited terminal space and low productivity.
- **"Soft Infrastructure" – ICT or Electronic based container/cargo clearance process is critical:** There was a view that implementation of soft infrastructure, especially through the planned "Port Community" and "Single Window" systems, will lead to major reduction of dwell times and hence increasing capacity, perhaps obviating the need for the proposed ICD integration program. It was agreed that whereas this is important and necessary, it does not address the limited space and low productivity of cranes and other equipment in the port.
- **ICDs are not preferable in the long term since they add cost and delays:** The recommendation builds on past successful and beneficial contribution of ICDs to reduce congestion. It seeks to enhance this contribution by streamlining and institutionalizing it to improve productivity. Regarding costs, the

additional cost of transfer to ICDs is far inferior to the savings on ships and truck costs expected from quicker turnaround as a result of improved productivity.

- **Requirement by revenue authorities (RA) that some cargo has to be processed in the port:** It was agreed that this should be treated as an implementation challenge. Consultations with RAs and a thorough analysis will be made on how RAs presence at the ICDs would ensure that such cargo would be equally secure at the ICDs. This also points to the need for coordination and collaboration to implement the proposed program and to actually succeed in improving efficiency at the ports.
- **Capability and professionalism of ICDs:** A point was made that some of the existing ICDs are small, ill-equipped, inefficient, have inadequate parking space and inexperienced in the shipping trade. However, the ICDs pointed out that if their business would be legitimized, resulting in a long term assurance of continuity, as opposed to operating as “illegitimate children” born out of a crisis, they would invest, improve and operate professionally. Indeed some of the ICDs/CFSs visited by the experts demonstrated good standards of facilities and professionalism. Furthermore, since the ICDs will be contracted competitively by shipping lines based on price and performance, they will be forced to improve and maintain high level standards. In addition, appropriate regulations and accreditation of the ICDs/CFSs as should also lead to necessary improvements. Also, the present tariff system needs to be modified to reflect market requirements rather than only punishing customers who do not clear their cargo in time!
- **Distance of ICDs from the port:** The inland ICDs are normally far away in areas where cargo is destined/originates. However the off-dock ICDs should be as close to the port as possible. In both ports, there are ICDs that are between 2 to 7 km from the port and there is potential to develop adequate ICD capacity within this radius up to 10 km.

Ports Authorities of both ports have plans to develop off dock ICDs far from the port, about 25 and 50 kilometers from Dar es Salaam and Mombasa, respectively. These ICDs would operate on the same concept proposed in the recommendation and are currently being studied. CDS did not review these in detail but the studies should determine whether or not these distances would be economically suitable. Furthermore, even if established, they should operate in competition with other ICDs, not port authorities' monopolies.

- **Marine container yard gates and access roads are congested:** The recommended program is meant to greatly improve the gate system by making it efficient and fast since the vehicles involved will be specially recognized for movement between marine container yards and ICDs. Checking and verifying will not be necessary since vehicles will be equipped with electronic sensors that prompt opening of an electronically controlled gate. Regarding access roads, some improvements will be needed such as strengthening the road pavement and/or installation of dedicated truck lanes. Some ICDs are prepared to invest in upgrading access roads to their facilities. Furthermore, the vehicle traffic involved with delivering or collecting cargo to/from the port, will no longer have to use one gate at the marine yard. Instead, they will be spread to deliver/collect containers/cargo to/from the many ICDs to be involved in the program.

Therefore in other words the severe congestion at one marine gate will be spread to several ICDs gates, and, hence, reducing congestion.

- **Inadequate or old equipment at ports are a major factor in ports inefficiency:** There were views that even if space is increased through the proposed integration program there may not be a substantial increase in productivity due to inadequate equipment. The response to this concern confirmed the necessity of the ports or terminal operators to invest in additional equipment. Ports and terminal operators have already started investing in additional equipment and have plans to continue doing so. In fact, the proposal provides an opportunity to widen the number of contributors to such investments since some of the equipment currently operating in the ports container yards will be procured and operated by ICDs. The ports will need to invest mostly in ship related equipment.
- **Need for the recommendation to be strengthened with an indication of the costs and benefits:** In order to motivate approval and acceptance of the recommendation by various institutions involved, there is need to clarify the costs and benefits, as well as other implementation challenges. This was accepted and the consultants undertook to include an indicative explanation of these aspects in the final report. They also explained that this initial consultation was to promote a concept for initial acceptance. Once commitment to proceed with implementation was established, a thorough analysis would be made of costs and benefits and various challenges with a view to establishing an appropriate guide to implementation.

## Conclusions and Recommendations

### DAR ES SALAAM ROUNDTABLE

The meeting generally agreed that the proposed concept is good and would be beneficial to the port system and users. A notable quote from one of the participants was “perhaps this may be the only way” to avoid a possible repetition of congestion, with adverse impact.

The meeting therefore recommended that the concept should be accepted and approved by relevant authorities for implementation. The consultant should provide a summary and basis of motivation for such approval. The summary should also provide an indication of costs and benefits; of implementation challenges and their possible mitigation, as well as an indication of the way forward.

### DAR ES SALAAM PORT MANAGEMENT

The management asked for and obtained clarification on a number of conceptual, technical and operational matters especially on the relationship between the port and ICDs. The meeting also concurred that the recommendation is valid and has the potential to solve the productivity and capacity problems in the immediate and short-term. A significant quote at the meeting is “ICDs saved us in time of need, they can save again in future.”

The meeting recommended approval of the ICD concept and to initiate the process of implementation; and the port expressed its desire to support the process.

### **MOMBASA ROUNDTABLE**

The meeting agreed that there is merit to consider implementation of the concept, while also taking into account various concerns and views expressed in the meeting. The concept was considered essentially as a partnership between KPA and CFSs, with collaboration of other parties involved in port operations (KMA, KRA, etc).

The meeting recommended that the concept should be considered for implementation. In order to assist in motivating approval and implementation, the consultant should include an elaboration of costs and benefits, especially to various key parties in port operations. The consultant should also include elaboration of implementation challenges and how best they should be mitigated. These include regulation of operations between Port and CFSs, tariff regulations and access roads improvement.

The Private Sector proposed including this proposal in its dialogue with Government, through the “Prime Minister’s Roundtable consultations with the Private Sector.”

Table B1. List of Participants - Tanzania Roundtable on Ports, October 1, 2010

<b>Last Name</b>	<b>First Name</b>	<b>Organization/Company</b>	<b>Designation</b>
Assenga	Predi	TICTS	Ag. Commercial Manager
Barantandikiye	Melchoir	TFFA Central Corridor	Logistics Specialist
Bhaduri	Nirjhar	Emirates Shipping Line	General Manager
Geva	Shaban	TAFFA	Director
Kaale	Jackson V.R	TASAA and Rails Shipping Services	Member, Management Council
Kakusa	Miwi	Tanzania Ports Authority	Manager, Planning
Karavina	Ally Aman	Spatial Development Ltd	Chief Executive Officer
Kumar	Suresh	PIL	General Manager
Lilani	Ali Hassan	TRH	PEMA
Loms	Raymond	SSB - Azam ICD	Operation/Safety
Moret	Charles	Nyota Tanzania Ltd	Managing Director
Ngatunga	Stephen	TAFFA	Executive Councilor
Ngoga	Frank	TFFA Central Corridor	Customs Specialist
Salvatory	Verena	TICTS	Marketing Officer
Senkoro	Aziz	TAFFA	National Treasurer
Shamte	Rukia	TFFA Central Corridor	Executive Secretary
Wandwi	Hussein, A.	TATOA	Executive Operations Officer

Table B2. List of Participants- Integrated ICD Concept - Dar es Salaam Port Management- October 4, 2010

<b>Name</b>	<b>Organization</b>	<b>Position</b>
Iddi Mkwata	TPA Dar Port	Dar Port Manager (Chair)
Eng. V.J. Madingo	TPA Dar Port	Principal Mechanical Engineer
M. W. Kakusa	TPA	Manager, Planning (TPA)
Peter Millanzi	TPA Dar Port	Ag. Principal Administration Officer
Capt. Andrew P. Matillya	TPA Dar Port	Oil Terminal Manager
H. A Hotti	TPA Dar Port	Ag. Revenue Manager
J. S. Sigera	TPA Dar Port	CTM
H. H. Arika	TPA Dar Port	CM
Eng. P. O. Ogulo	TPA Dar Port	Maintenance Engineer
Capt. Juma Saire	TPA Dar Port	HM
D. S. O. Kissa	TPA Dar Port	TM
H. J. Mwasenga	TPA Dar Port	PSTO
Stephen A. Mlabwa	TPA Dar Port	BOM
James M. Nglwandy	TPA Dar Port	PSO
Eng. W. Bashushu	TPA Dar Port	CTE
Gati Nyirabu	TPA Dar Port	SOO
Juma Mwenda	TPA Dar Port	SA
Michael Chinamo	TPA Dar Port	Ag. Financial Manager
Mathew Anthony	TPA Dar Port	Principal CPS Officer
Maghibo Murta John	TPA Dar Port	SOO
Bosco Mganwa	TPA Dar Port	SME
Tatu A. Moyo	TPA Dar Port	SOO

Table B3. List of Participants Roundtable on Integrated ICD Concept - Mombasa October 5, 2010

<b>Name</b>	<b>Organization</b>	<b>Position</b>
Geoffrey Mwangi	Kenya Maritime Authority	Research & Development
Charles Kahuthu	Kenya National Chamber of Commerce	Manager
Daniel Kiange	National Single Window System	SBA
James Mwayayi	Kenya Ports Authority	Operations Officer
Alex Kabuga	National Single Window System	Project Team Leader
John Mwanza	ISCOS	Director of Shipping
Peter Oremo	Kenya Ports Authority	Manager
Jairus Esibwe	ISCOS	Director of Ports & Statistics
Grace Maina	Kenya Transport Association	Ag. Executive Officer
Salim Nasib Mbarak	Weston Logistics	Managing Director

Jim Siro	Maersk K Ltd	Operations Manager
Mansour Mohammed	Interpel CFS	Marketing Manager
Sudi Amani	Kenya Ports Authority	Terminal Manager



# Appendix C. Peer Review

## Introduction

This appendix summarizes a series of discussions of the Corridor Diagnostic Study (CDS) team with five experts selected by DIFD to review the initial Draft Working Paper describing the proposed Integrated ICDs program (Integration Program).

The reviewing experts include:

- Rolf Nielsen, Managing Director, Maersk Kenya
- Andrew Roberts, Senior Operations Officer, African Region Integration Department, The World Bank
- Jay New, Chief Representative Africa, Hutchinson Ports Holding
- Anthony Hughes, Managing Director, Marine Logistics Limited
- Silas Kanamugire, Transport & Trade Facilitation Advisor, Trade Mark

The discussions were held during two in face-to-face meetings and respective phone and video conferences on October 4 and 6, 2010 in Mombasa and Nairobi. Mark Povey, DFID Regional Growth Trade and Investment Advisor, also took part in the discussions.

The Working Paper is organized by reviewers, with each reviewer given a special section. The sections, in turn, are organized by concerns, each followed with our response. In case of similar concerns expressed by several reviewers, we only include these concerns and our responses once, in the section of the first reviewer to raise them. Some of our responses are lengthy. These are in cases we thought that clarifying and expanding on pivotal components of our proposed Integration Program would be warranted.

These concerns and responses discussed in this appendix are organized by the following areas:

- ICD Performance
- Alternative Solutions
- Ancillary Improvements

- Limited Benefits or Increased Costs

## ICD Performance

### OBJECTION THAT SOME INEFFICIENT ICDS ARE POLITICALLY-CONNECTED

**Concern:** Some of the existing ICDS are small, ill-equipped and inefficient. However, these ICDS are owned by well-connected parties. The Integration Program advocates cancelling the “assignment system” (in Mombasa) and allowing free-market contracting of ICDS by shipping lines, along with the accreditation and regulation of them. Implementation of the Program may put the small and politically-connected ICDS out of business. These ICDS will object to the Program, rendering it theoretical and, perhaps, impractical.

**Response:** We are well aware of the problems associated with the small and politically-connected ICDS. Their future role is a difficult problem that has to be resolved. One way to resolve it is to encourage these ICDS to improve their facilities via consolidation. In fact, we have already found that some of the smaller ICDS, being aware of their deficiencies, already either have plans or are actually involved in expansion programs.

Also, if the present tariff system is modified to better reflect costs, the small ICDS could specialize in handling smaller lines, offering them lower rates and/or services tailored to their needs.

A general note is also due here. The problem of small and inadequate ICDS was also raised and extensively discussed during our two sessions with stakeholders. None of the participants described the expected resistance by small ICDS as a major problem. One participant even indicated that all ICDS are politically connected, without such connections they will not be in the port business.

### LACK OF ICD CAPACITY

**Concern:** The present ICDS lack the capacity to handle the additional traffic generated by the Integration Program.

**Response:** According to our interviews (and Jay New’s calculation) the reverse is true; there already is a substantial over capacity in the ICDS in both ports. Likewise, there are several large and modern ICDS presently under construction. One participant in the workshop estimated that once the new ICDS are inaugurated, the overcapacity could reach beyond 100 percent (capacity = 2 x demand).

Moreover, a review of the area around both ports also indicates availability of land that can be developed. Converting these lands to ICDS is relatively inexpensive, involving paving, fencing and purchase of reach-stackers. Hence once the present “punitive” tariff is modified and adjusted to reflect the changes in the dwell-time situation, more facilities will be developed in response to the growth in demand.

It also should be noted that according to our estimate about 60 percent of the import boxes are already handled by ICD/CFS facilities. Hence, the additional traffic generated by the Program may not be substantial. However, a further analysis is required to better assess the capacity of ICDS and their economic cost structure.

## THE NEED FOR ACCREDITATION AND REGULATION OF ICDs

**Concern:** Some of the ICDs have small and inadequate facilities, resulting in long waiting lines of trucks.

**Response:** We fully agree that an important part of the Program should include Accreditation and Regulation of ICDs, as already noted above. Still, we would like to point out that the ICDs reviewed by us had superior facilities (adequate peripheral security systems, paved and clean yards, new RSs and adequate Custom and Port Authority offices, waiting places for drivers, internal security forces, etc.).

It should also be noted that since the Program also includes free competition among ICDs, market forces will force ICDs to improve their services and lower costs. Simply put, shipping lines will make sure that the ICDs with which they have contracts provide good services to their mutual clients, cargo owners.

## Alternative Solutions

### ADDITIONAL YARD AREA AVAILABLE IN MOMBASA

**Concern:** The Draft Working Paper was reviewed by the World Bank's port experts, who indicated that Mombasa had a large area used for residential purposes by port employees. This area could be converted into container yard to be added to the current yard which, according to the Working Paper, is limited.

**Response:** The indicated area is not applicable for expanding the container yard (CY). The area is located on a hill, not adjacent to the container yard. Also, the removal of the residence places of port staff including, as we understood the Managing Director himself, seems to be politically difficult. Hence, while the overall suggestion of converting residential area into port handling area should be pursued despite the political difficulties, its implementation is not expected to increase the capacity of the port to handle containers. Likewise, the implementation might take a long time.

It should be noted that the Integration Program's main objective is NOT increasing the container yard area but eliminating outside trucks from the port and the respective traffic congestion at the gate and inside the terminal. A secondary objective is to simplify terminal processing, converting it to block operations. Outside trucks and the need to locate specific containers is perceived as the main reason for terminal congestion, resulting in low berth and cranes' productivity and, subsequently low overall terminal capacity.

### NO ASSESSMENT OF NEW, GREEN-FIELD MARINE TERMINALS

**Concern:** Both the ports of Dar es Salaam and Mombasa have plans for new terminals that may render the Integration Program unnecessary.

**Response:** We reviewed the master plans of both ports and included a brief summary of the expansion projects, including new terminals, in our Working Paper. The new terminals may have large container yards, which may render the removal of containers to ICDs unnecessary. However, realization of these plans may take three, possibly more years. Given the rate of traffic growth, doing nothing until then leaves the ports with

the possibility of experiencing a repeat of disastrous congestion cycles, possibly even more serious than earlier ones. The proposed Integration Program is intended to improve the utilization of existing terminals and it can be implemented immediately, since it mainly requires institutional changes.

The ICDs will be required even when the new terminals are in operations. According to ports' master plans the new terminals will only handle about half of the traffic. Hence, the existing terminals will continue operating and will still require the support of off-dock ICDs for optimal productivity.

## CONSEQUENCES OF NOT TAKING ACTION

**Concern:** The Working Paper should elaborate on the consequences of not undertaking the Program, especially the re-appearance of long waiting lines of ships and possible imposition of congestion surcharges.

**Response:** We fully agree with this concern and have modified the Working Paper to better reflect these consequences both on ship and truck costs. If required, the next phase or analysis of implementation challenges and process should include a detailed calculation of the congestion costs of ships and trucks, comparing them with the costs of transfer to ICDs. Developing a comparative cost calculation also was recommended by workshop participants.

## NOT ADDRESSING OFF-DOCK INTERMODAL TERMINALS

**Concern:** A substantial portion of the import boxes, both domestic and transit, is destined to far-away hinterland points and therefore should be better served by rail. The rail handling should be conducted at an intermodal terminal located outside the city limits, with the transfer between the marine terminal and off-dock intermodal terminal carried out by shuttle trains<sup>9</sup> The Working Paper does not mention these intermodal terminal developments.

**Response:** We are fully aware of the rail-oriented traffic, the analysis of which is included in the broader study of the Central and Northern Corridors. Our Working Paper on Integrated ICDs does not review the various alternatives for intermodal developments simply because they are oriented toward a medium to long-term timeframe. We also understand that a study specifically dedicated to off-dock intermodal terminal is currently undertaken in Dar es Salaam with the assistance of the World Bank.

It should be noted that the current percentage of boxes using rail is very low. All intermodal handling are currently performed on-dock, using back-of-terminal intermodal yards. To facilitate the handling of rail-bound boxes we suggest in our Integration Program that boxes with firm rail bookings will be moved directly from ship to the stacking area of the on-dock rail facility ("RMG" area), while the rest are transferred to ICDs. It

---

<sup>9</sup> The concept of shuttle train from ports to intermodal yards was studied for the US ports of Los Angeles/Long Beach, using the Alameda Corridor as well as for Rotterdam and other European ports.

should be noted that transit boxes tend to stay long time in the port, taking much of the container yard storage space. Likewise, handling trucks transporting these boxes is awkward, since often it requires convoys. Hence, removal of transit boxes will contribute much to ease terminal congestion (this also was Jay New's observation). The Custom's procedures for removing these boxes and later on returning them for rail handling should be analyzed in the next phase (if any).

## **Ancillary Improvements**

### **NEED FOR ADDITIONAL SHORE CRANES**

**Concern:** Present terminals have shortage of shore equipment (cranes). Without adding cranes, expected productivity gains following the Integration Plans cannot be realized.

**Response:** We fully agree with this concern and suggest including a review of marine terminals' equipment in the next phase of analysis of implementation challenges and process.. It should be noted, however, that based on our latest port development project, the lead time for ordering, shipping and installing a gantry crane is usually 1.5 - 2 years. Mobile harbor cranes can be purchased and installed within a year. The focus of our Program as noted before is on immediate measures that do not involve major capital investments. Hence, while we concur that additional equipment should be procured as quickly as possible, we can still gain a certain level of capacity enhancement by improving the productivity of the existing equipment to begin with.

### **ALLEVIATE RESTRICTIONS IN DEPTH ALONGSIDE BERTHS, ACCESS CHANNEL AND TURNING BASIN**

**Concern:** Access channels and depth alongside berths are too shallow and turning basin is too short to allow the handling of larger ships.

**Response:** We fully agree with this concern. We also understood that both ports have elaborated dredging programs. As noted above, implementation is intended for the long term while our study is geared for the short term.

### **OTHER MEASURES REQUIRED TO ENHANCE PRODUCTIVITY**

**Concern:** In addition to yard congestion, there are several other impediments to increasing berth productivity, among them: late filing of manifests by shipping lines; inaccurate declaration of box weights by lines; need for additional shore cranes; the need to install shore cranes equipped with twin lifts; lacking labor skills in operating shore cranes; unavailability of berthing windows; prohibiting incentive pay system for labor; and deployment of older ships by lines.

**Response:** We fully agree with this concern and suggest to include these measures in the next phase of analysis of implementation challenges and process. It should be noted, however, that some of these measures (e.g., new cranes) are geared for the medium to long-term.

In addition to twin-lift spreaders, it is suggested to examine the possibility of lifting two (or even three) empty boxes piggyback, a common practice in ports handling a large number of empty containers.

## Limited Benefits or Increased Costs

### PARTIAL IMPLEMENTATION

**Concern:** The removal of all import boxes advocated by the Integration Program is too costly especially for importers who presently claim their cargo at the marine terminals. Hence, the Program should consider allowing boxes with short dwell time of, say, three or fewer days, to remain at the marine terminals for direct delivery.

**Response:** The Program's main objective is removing ALL outside trucks from the marine terminals, allowing them to concentrate on vessel handling. Upon implementation of the Program, the present marine terminal gate will be turned into an internal gate handling only ICD traffic and the container yard turned into "pure" block stowage. Allowing some of the boxes to be claimed at the marine terminals requires the container yard to provide single-box selectivity, allow outside trucks into the terminal, requires scanning, inspection and elaborate gate processing; thus undermining the main objective of the Program. Another problem is with importers declaring their intention to claim their boxes within the grace period and failing to do so.

A general note on cost is warranted here. The Program may indeed increase costs for efficient importers who presently process their cargo promptly and claim it directly from the marine terminals, avoiding the transfer to ICDs. We believe that if the Program is properly implemented, even importers currently claiming their boxes at the marine terminal will benefit from it. According to our interviews, the present truck turnaround time at the port ranges 4 - 8 hours, compared to less than 1 hour in efficient private ICDs.

### LIMITED IMPACT ON PRODUCTIVITY

**Concern:** According to the Program, the main impediment for berth productivity is container yard congestion or the high utilization of yard slots. This presumption is contradicted by recent developments whereby yard utilization has gone down while berth productivity remains unchanged (low).

**Response:** We have not reviewed recent data and cannot comment the reduction in container yard slot utilization and its limited impact on berth productivity.

Reducing container yard utilization is only secondary objective of the Program; its primary objective is "cleaning" the marine terminal from outside trucks and providing for block operation. This will allow the marine terminals to focus on increasing berth productivity and the respective increase in capacity of existing marine terminals. It should be noted that the combination of discharging import boxes using block storage ("dumping"), and loading mainly empty boxes turns the ship handling process much simpler than present operations. Hence, once the Program is fully implemented, we see no reason why crane productivity should not be comparable to that in other ports worldwide serving the same ships with similar cranes.

## INTEGRATED ICDs MAY INCREASE TRAFFIC CONGESTION

**Concern:** Moving a large number of boxes between the marine terminals and ICDs will increase the traffic on the roads surrounding the ports and around the ICDs, further exacerbating congestion. Hence, the Integration Program will not solve the congestion problem; it will simply move the congestion from the port to the nearby off dock ICDs.

**Response:** Moving the traffic and respective congestion from the port to the ICDs is indeed the intention of the Integration Program. Put differently, instead of concentrating all the traffic at a single gate of the marine terminal, we plan to distribute it over 5-10 gates of ICDs located in several areas around the port, each location handling 10-20 percent of this traffic and therefore much less congested. Moreover, this distribution of traffic is expected to ease the congestion at the area which we believe is the most critical – the port.

There are three additional points that we would like to make here regarding the port-area congestion following implementation of the program:

1. The Program includes improvements of access roads to ICDs to be financed by the private ICDs themselves as part of their capital improvement programs in anticipation of the increase in traffic following the Program;
2. Unlike the current situation of disorganized truck traffic, the transfer of boxes between the marine terminal and ICDs will be planned, mostly conducted at night and by trucks specializing in this traffic; and
3. The Program includes accreditation and Level-of-Service regulation of ICDs, in which they will be required to provide parking places for trucks, develop truck appointment systems and compile performance data (e.g., truck turnaround time).<sup>10</sup>

To restate the above, we believe that the Integration Program, if properly implemented, will substantially reduce traffic congestion in and around the port.

## THE PROGRAM ONLY FOCUSES ON THE SHIP-TO-SHORE INTERFACE

**Concern:** The Integration Program only addresses one link in the transportation chain, the ship-to-shore interface. There are more important links that should be addressed first, such as hinterland trucking and rail systems.

**Response:** The overall analysis of the Corridors is included in the CDS study, including cost calculation conducting using the *FastPath* model. The Integration Program focuses on the ports which, following the near-

---

<sup>10</sup> For example, the new Interpel facility in Mombasa includes 30 pre-gate parking slots.

term growth may simply block the entrance to the Corridors as was the case in 2006. Hence, we believe that improving the ship-to-shore interface is a priority. In the diagnostic analysis using the FastPath model, within the port system, we identify that the berth productivity is the main bottleneck.

To relieve this bottleneck, we suggest to “clear” the marine terminals from trucks and individuals processing cargo (drivers, clearing agents, cargo owners, brokers). This will greatly simplify terminal operation, allowing the port authorities and private terminal operators to concentrate on the ship-to-shore interface and radically improve it. The most scarce and expensive resource in every marine terminal is the berth. Hence, the focus is appropriately the berth, as suggested by the concern.

### **TEMPORARY SOLUTION AT THE EXPENSE OF MORE PERMANENT SOLUTION**

**Concern:** Relieving congestion inside the marine terminal may increase berth productivity. However, this is only a short-term solution and that may come at the expense of more permanent ones such as new access roads, changing the zoning in the areas surrounding the ports, encouraging the penetration of containers to the hinterland (door-to-door), development of off-dock intermodal terminals to facilitate this penetration, etc.

**Response:** We fully agree with this concern. The Integration Program is indeed a temporary measure, which is relatively easy to implement since it is institutional by nature and does not require major capital investments. The measures listed in the above concern are long-term and should not be affected by the Program. On the contrary, the Program is intended to provide Dar es Salaam and Mombasa with the “breathing space/time” until the proposed measures are implemented.

## **Summary**

The long list of concerns and responses in the above sections may create the impression that the reviewers disagreed with the Integration Program. This, however, was not the case. While described as bold and, perhaps, extreme, the reviewers agreed that the Program has good prospects assuming their concerns are properly addressed. Put differently, none of the reviewers suggested discarding the Program or any alternative short-term program.

We believe that an extreme measure such as that proposed in the Integration Program is required, indeed. The consequences of not implementing this Program may be dire: continued low productivity resulting in congested marine terminals, long waiting lines of ships and trucks and substantial increase in the cost of transportation reaching a crisis level. The crisis in 2006 was indeed the reason of developing ICDs in 2007. Preventing a reoccurrence of the crisis requires further development of these ICD and, especially, better integrating them with the marine terminals.