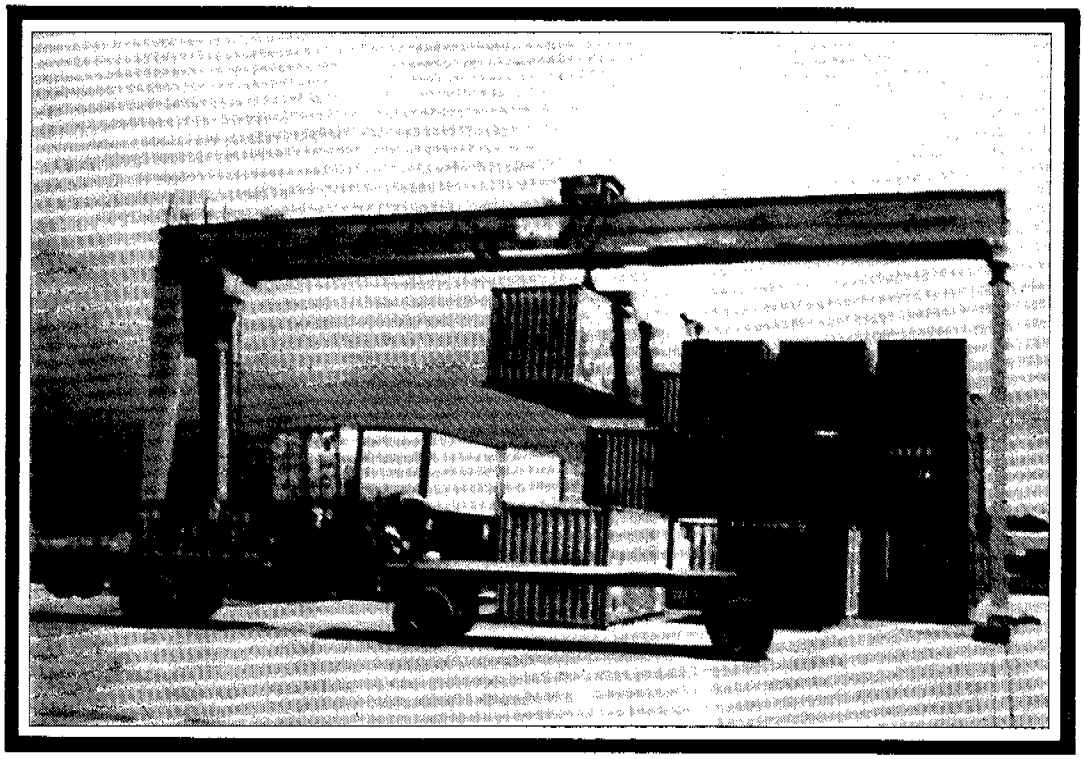
(UNCTAD/RDP/LDC/7)

HANDBOOK ON THE MANAGEMENT AND OPERATION OF DRY PORTS



UNITED NATIONS CONFERENCE ON TRADE AND DEVELOPMENT
(UNCTAD)
Geneva, 1991

PREFACE

The aims of this Handbook on the Management and Operation of Dry Ports are threefold:

Firstly, the Handbook seeks to provide a planning guide for universal application of the general procedures involved in the establishment of dry ports, which are also known as Inland Clearance Depots (ICDs). For planning purposes, dry port location principles, site considerations and the question of scale are also addressed.

Secondly, the text describes typical characteristics of dry ports, notably their facilities and layout. Their potential benefits are listed and their role within the through transport system is analysed. The effects of containerization with particular reference to dry port operations are summarised including responsibilities of the multimodal transport operator. Relevant customs conventions and procedures concerning dry ports are also covered.

Thirdly, an administration and management structure for dry ports is outlined, suggestions on marketing strategies aimed at ensuring the long-term profitability of such facilities are discussed. It is recognised that, in the early days of development, special promotional measures such as fiscal incentives and high profile advertising may be required to present the benefits of the dry port concept to potential customers. A dry port's economic viability, and ultimately its survival, will often depend largely on its achieving high customer satisfaction stemming from a commitment to provide a good service at a competitive price.

(UNCTAD/RDP/LDC/7)

CONTENTS

LIST OF FIGURES AND TABLES

Figure

Table

LIST OF ANNEXES

Annex

Glossary of Terms and Abbreviations

ASYCUDA - Automated System for Customs Data

BILL OF ENTRY - A document presented by an importer or his agent to the customs house declaring the nature, value and other details of the goods imported or intended for exportation.

BILL OF LADING - A written account of goods shipped by any person, signed by the carrier, acknowledging the receipt of goods or promising to deliver them safely at the place directed, or otherwise setting forth the terms of contract of carriage.

BIC - Bureau International des Conteneurs

BONDED WAREHOUSE - A warehouse under bond to the customs authorities for payment of duty and taxes on goods stored or handled there.

BREAKBULK CARGO - Cargo which is in loose form; not containerized.

CCA - Common Customs Area.

CCC - Customs Convention on Containers; Customs Co-operation Council.

CFR - Cost of Freight ..... (named point of destination).

CFS - Container Freight Station - shed where breakbulk cargoes from several different consignors are received, aggregated and stuffed into a container; or where cargoes for several consignee are unpacked from a container for delivery.

CIF - Cost Insurance and Freight - a form of price quotation which comprises all charges for goods to the point of unloading.

CIP - Carriage and Insurance Paid to ..... (named point of destination).

COFC - Container On Flat Car (flat railway wagon).

CPT - Carriage Paid To ..... (named point of destination).

CTD - Combined Transport Document - a negotiable or non-negotiable document as evidence of a contract for the performance and/or procurement of combined transport of

goods and bearing on its face either the heading "Negotiable Combined Transport Document issued subject to Uniform Rules for a Combined Transport Document (ICC Publication No. 273)" or under the heading "Non-negotiable Combined Transport Document issued subject to Uniform Rules for a Combined Transport Document (ICC Bronchure No. 273)". These rules have now been superseded by a new set of rules called "UNCTAD/ICC Rules for Multimodal Transport Documents".

CTO - Combined Transport Operator - meaning a person (including any corporate company or legal entity) issuing a CTD.

CY - Container Yard.

COMBI-CARRIERS - Ships carrying both (loaded or empty) containers and breakbulk cargoes.

COMBINED TRANSPORT - Multimodal transport or carriage of goods by at least two different modes of transport (sea, rail, road, air, or inland waterway).

DAF - Delivered At Frontier ..... (named point).

DDP - Delivered Duty Paid ..... (named point of delivery).

DDU - Delivered Duty Unpaid ..... (named point of delivery).

DEQ - Delivered Ex Quay (duty paid) ..... (named port of destination).

DES - Delivered Ex Ship ..... (named port of destination).

DT - Dwell Time.

DEMURRAGE - A charge for detaining a freight car, ship or other vehicle beyond the free time stipulated for loading or unloaidng. Demurrage may also be levied by a shipper on a consignee for containers held beyond an agreed date, or for failure to take delivery of stored goods within a specified time.

DOCUMENTARY BILL - A bill of exchange drawn on a consignee of goods and having appended to it the shipment document by way of collateral security for its payment.

DRY PORT - Customs clearance depot located inland away from seaport(s) giving maritime access to it (see also ICD).

ECE - Economic Commission for Europe.

EDP - Electronic Data Processing.

ER - Equipment Receipt.

EXW - Ex Works ..... (named place or factory).

FAS - Free Alongside Ship ..... (named port of shipment).

FCA - Free Carriers ..... (named place).

FCL - Full Container Load - cargo consigned to a single importer/agent or from a single exporter, and not needing to be dealt with at the CFS. The container may or may not be fully loaded.

FIATA - International Federation of Forwarding Agents' Associations.

FLTs - Folk-Lift Trucks.

FOB - Free On Board ..... (named port of shipment) without charge for delivery to and placing on board a carrier at a specific point.

FUMIGATION - Procedure by which cargo likely to carry pests is disinfected in order to halt the spread of infestation.

GATT - General Agreement on Tariffs and Trade.

GRT - Gross Registered Tonnage - the overall measurement of the dimensions of a ship - the total volume below the full upper deck (one registered ton is equal to 2.83 cubic metres).

ICC - International Chamber of Commerce.

ICD - Inland Clearance Depot - a terminal located in the hinterland of a gateway port serving as a dry port for customs examination and clearance of cargoes, thereby eliminating customs formalities at the sea port. Alternatively also known as an "Inland Customs Depot" (see also Dry Port).

IRU - International Road transport Union.

ISO - International Organization for Standardization.

IWT - Inland Waterway Transport.

INCOTERMS - Internationally accepted Commercial Terms used for International trade.

JIT - Just-in-time (Inventory).

LCL - Less than Container Load - a container holding cargo of several importers or exporters.

LDC - Least Developed Country (ies).

MTD - Multimodal Transport Document.

MTO - Multimodal Transport Operator.

MANIFEST - A detailed list of ship's cargo for the information of ship's agents, customs officials, etc., delivered by the master of a ship.

MATE's RECEIPT - A temporary document issued by the Mate of a ship acknowledging receipt of the goods on board to be exchanged in due course for a Bill of Lading.

NVOCC - Non-Vessel Operating Common Carrier.

NVOMTO - Non-Vessel Operating Multimodal Transport Operator.

O-D - Origin-Destination.

PTA - Preferential Trade Area for Eastern and Southern African States.

PACKING/UNPACKING - The process of filling/emptying a container. Also referred to as Stuffing/Unstuffing.

PRIME MOVER - See TRACTOR.

RO-RO (Ships) - Roll On/Roll Off (ships) - vessels designed to carry wheeled cargo loaded and unloaded via ramps.

SHIPPER - An importer or exporter using shipping services to transport goods.

STUFFING/UNSTUFFING - See PACKING/UNPACKING.

TEU - "Twenty-foot Equivalent Unit" - a reference size in which all containers are generally quoted in relation to one 20-foot container (e.g. a 40-foot container is equal to two (2) TEUs).

TIR - Transport Internationale Routier.

TOFC - Trailer On railroad Flat Car (piggy back system).

TRACTOR - Self-propelled vehicle for towing loads, including containers, trailers, etc. (see also PRIME MOVER).

TRAILER - Wheeled vehicle supporting loads (e.g. a container fixed on it) drawn by a prime mover or tractor.

UNCTAD - United Nations Conference on Trade and Development.

WHARFAGE - A charge assessed for handling incoming or outgoing cargo on a Warf.

SECTION ONE

DRY PORTS, CONTAINERIZATION AND MULTIMODAL TRANSPORT

A. **Dry Ports Defined**

An early definition of a dry port which appeared in a United Nations text in 1982 was:

"An inland terminal to which shipping companies issue their own import bills of lading for import cargoes assuming full responsibility of costs and conditions and from which shipping companies issue their own bills of lading for export cargoes."

Dry ports could be inland terminals within a country that has a gateway port or they could be located in adjacent land-locked countries in the hinterland of one or more sea ports. The concept came into widespread use in conjunction with containerization and this is the context in which the term is used here. Recently a Dry Port or Inland Clearance Depot (ICD) was defined as:

"A common user facility with public authority status, equipped with fixed installations and offering services for handling and temporary storage of any kind of goods (including containers) carried under customs transit by any applicable mode of transport, placed under customs control and with customs and other agencies competent to clear goods for home use, warehousing, temporary admissions, re-export, temporary storage for onward transit and outright export." (ECE/UNCTAD/CCC).

Simply stated, dry ports are specific sites to which imports and exports can be consigned for inspection by customs and which can be specified as the origin or destination of goods in transit accompanied by documentation such as the combined transport bill of lading or multi-modal transport document.

By definition, dry ports are located inland from sea ports but are linked directly to the sea port(s) or, in the case of international land movements, are in contact with the sources of imports and destination of exports. Dry ports may be used whether a country has sea ports or is land-locked, but only surface modes of transport are involved in giving access to them.

A holding compound subject to a security cordon is a prerequisite for a dry port. Dry ports will include temporary storage. Both existing customs and clearance facilities as well as specific facilities built for the purpose may be designated as dry ports. It is essential that a dry port be a common user facility such that it is accessible to all shippers either directly or through their agents. Public ownership and private operation on a common user basis are perfectly feasible and indeed occur in a number of countries. It is essential to avoid providing facilities that are for the exclusive use of only some clearing and forwarding agents such that conditions are created for the operation of a cartel, or whereby one or a few clearing and forwarding agents or transporters can exert leverage over the remainder.

Frequently, it will be desirable to make provision for consignments of goods, especially bulk goods, to be delivered directly to or collected directly from, the premises of large clearing and forwarding agents, major storage facilities or other points of substantial transport demand, such as factories or power stations where inspection by the customs and verification of delivered quantities by the transporter will take place. Although such consignments would not pass directly through a formally designated dry port, their paperwork probably would.

Transfer between transport modes takes place at a dry port (from road to rail or vice-versa; road or rail to inland water transport or vice-versa). Dry ports are also likely to be the places where large consignments are assembled or separated into smaller loads for onward transit (i.e. when consolidation or groupage occurs). Depending on the commodities, dry ports may need to be able to deal with liquids in tankers, dry bulk cargo, non-containerized general cargo and mixed cargo. Most commonly, however, dry ports are heavily geared towards handling unitized cargo.

Dry ports are closely associated with the promotion of the through-transport concept. This service is most readily achieved by switching to the use of containers. The door-to-door transport concept involves the adoption of procedures to transfer goods from their place of origin to their final destination without intermediate customs examination; thereby intermediate handling occurs only at points of transfer between different transport modes. For land-locked countries, the concept envisages no internal examination of goods or containers by customs at the seaport; a customs transit procedure will need to be implemented in the maritime countries. Implementation of the door-to-door transport concept offers a potential for substantial transit cost savings to be reaped. When the introduction of dry ports is associated with simultaneous implementation of the door-to-door transport concept, facilities provided at the dry ports need to have the capability of handling full and empty containers, including stuffing and unstuffing of containers as well as short-term storage of containers. In the case of land-locked countries, one document, a multi-modal transport document, would be issued for the conveyance of:

(a) Exports from the dry port in the land-locked country to the seaport or dry port of the importing country, or

(b) Imports from the sea port or dry port of the exporting country to the dry port in the land-locked country.

Cargo which is internal to the country concerned may also arrive at or be despatched from the dry port and so a procedure is needed for segregating it from bonded freight.

B. **Dry Port Facilities**

The facilities provided at a dry port can vary considerably. Minimum facilities would provide:

- Customs control and clearance;
- Temporary storage during customs inspection;
- Container-handling equipment for 20-foot and 40-foot containers;
- Offices of an operator, either the site owner, lessor or contractor;
- Offices of clearing and forwarding agents;
- Complete enclosure, fencing and a security system;
- Reliable and efficient communication facilities;
- Container freight station with stuffing and unstuffing services.

An alternative to providing on-site offices for clearing and forwarding agents is for them to be accessible on radio call. Stuffing and unstuffing (packing and unpacking) services are often provided directly by forwarding agents or the operator.

A dry port with a more comprehensive set of facilities would include:

- Offices of shipping line agents;
- Railway goods office;
- Road haulage brokerage;
- Cargo packing services;
- Consignment consolidation services;
- Unit train assembly and booking services;
- Container clearing services;
- Computerized cargo-tracking services;
- Container repair facilities;
- Clearing and fumigation services (atmospheric and vacuum);
- Refer refrigeration points;
- Weigh bridges.

This list of facilities covers dry ports designed to handle primarily break-bulk loads in small consignments, full-container loads (FCLs) and less-than-container loads (LCLs) selected for customs inspection. It is considered inappropriate to have on the immediate site of the dry port long-term storage and repair facilities for trucks or rail wagon or locomotive maintenance. A generalized functional structure of an inland clearance depot or dry port is shown in Figure 1.

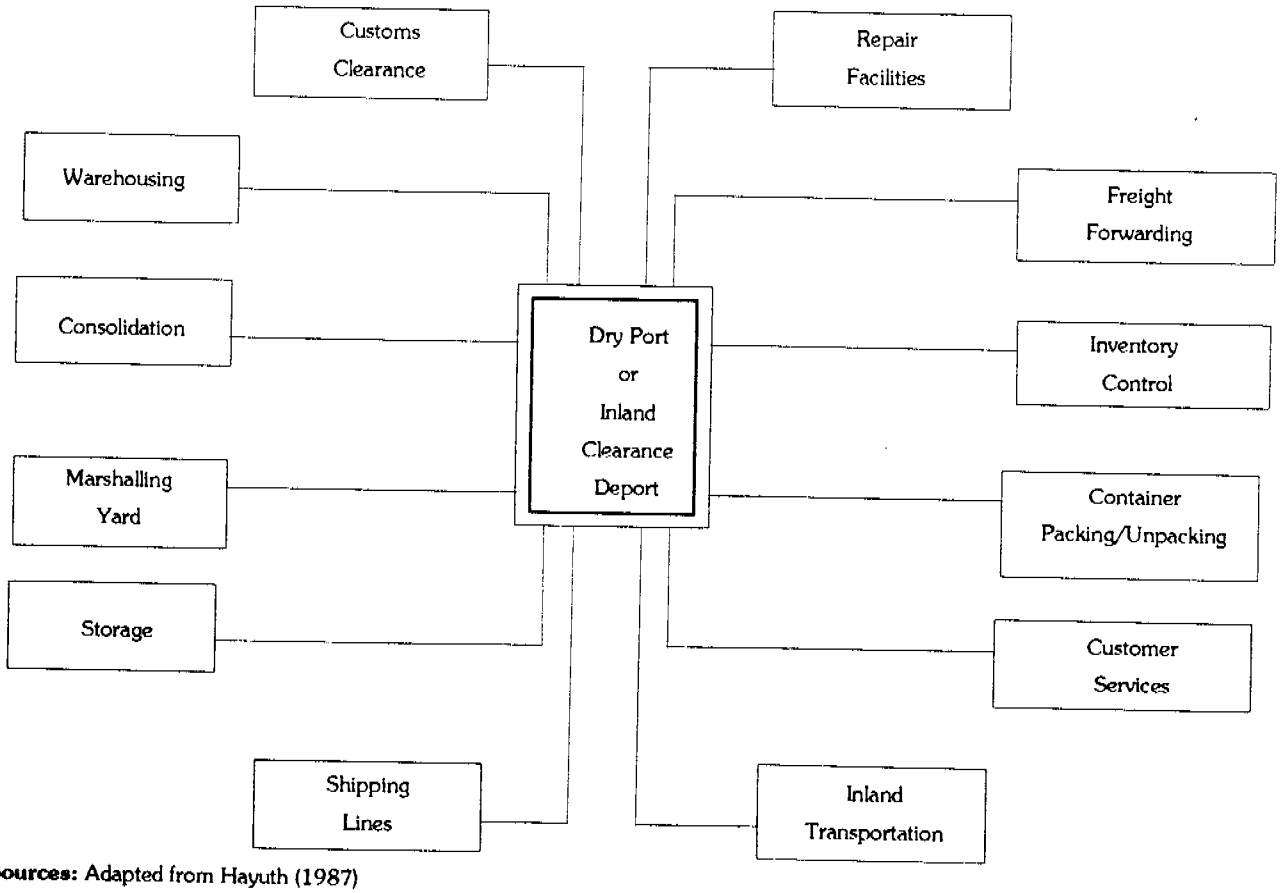
C. Potential Benefits of Dry Ports

The benefits arising from setting up dry ports and related developments differ for each case considered, depending upon the existing procedures, charges levied, routes used, facilities provided and local conditions. The benefits and potential benefits may be summarised as follows:

(a) *Increased trade flows*: beneficial to a region or to the country as a whole.

(b) *Lower door-to-door freight rates*: The consolidation of consignments and the greater use of containerization can contribute significantly to the introduction of lower through-rates. Containerization offers numerous advantages. Greater use of containerization, with boxes routed through dry ports, encourages a reduction in handling costs en route, as well as less ship time and port costs. Most transport tariffs taper off with increasing distance; hence the cost per unit of distance normally decreases as the length of the haul increases. In traditional transit practice, it is usual for each leg within a through haul to be charged separately. With door-to-door transport of goods via a dry port, it may be possible to negotiate lower movement costs when the quoted rates apply to the whole length of the haul, thereby yielding advantages as a result of the "taper" effect, thus reaping economies of scale in terms of transport distance.

Figure 1: **Functional Structure of Dry Ports or Inland Clearance Depots**



Sources: Adapted from Hayuth (1987)

(c) *Avoidance of clearing and forwarding agents' fees at sea ports:*

These fees may be completely avoided where a dry port allows the use of combined transport bills of lading or multi-modal transport documents. This is so when such documents are issued by a shipping line because the shipping line takes responsibility for the passage of the goods through the maritime port. Hence the importer or exporter does not need to employ a clearing and forwarding agent.

(d) *Avoidance of storage, demurrage and late documentation fees:*

In traditional transit systems, goods are frequently held up at maritime ports or at land borders owing to the absence of documentation (such as ocean bills of lading or commercial invoices), minor irregularities in existing documentation, prepayment of handling charges in foreign currency, lapse of a bond, non-availability of onward transport, etc. In all such circumstances, storage charges beyond the permitted free periods allowed may accrue, or demurrage charges and late documentation fees may arise. With a dry port and combined transport bills of lading, customs inspection at the maritime ports and at the borders of transit countries should be unnecessary or at least greatly minimized and many of the usual causes of delay at maritime ports will be removed. Storage costs, demurrage and late documentation fees will thus not occur.

(e) *Possible avoidance of the need to extend the period of marine insurance:*

The validity of the period of marine insurance usually extends to 60 days after completion of discharge overside of the goods insured from the sea-going vessel at the final sea port of destination. With a dry port, delays in excess of 60 days should not occur, and the payment of any additional premium is thus averted. The marine insurance could end at the dry port itself if it has been designated as the final destination. Such coverage could also cease at the dry port if long-term storage takes place there or if the goods are kept there for distribution. An extension of coverage may be required, however, if goods are consigned to a dry port.

(f) *Optimal use of road and rail transport:*

If substitution of existing long-distance road haulage by rail transport can be encouraged, there may be savings to be gained in transport costs. This possibility can be assessed by finding the difference between rail and road through-transport costs.

(g) *Use of national rolling stock:*

Benefits may also be gained when a dry port enables cargo to be transhipped more readily from foreign-owned to domestic-owned rail wagons, if necessary, such that the demurrage

or hire-rate on foreign wagons is avoided when wagons are returned quickly to the foreign railway. It should be noted, however, that the purpose of the dry port and the combined transport document is to reduce transhipment with its attendant handling costs to a minimum.

(h) *Better utilization of capacity:*

A dry port can reduce empty rail wagon or truck movements by acting as a consolidation centre for return loads of export cargo. The consignment increase in load factor may enable some savings to be made in overall transport costs.

(i) *Greater use of containers:*

The establishment of a dry port with container-handling facilities can encourage greater use of containers. The additional benefits have been separately listed in the chapter on containerization.

(j) *Lower customs staff costs:*

As dry ports allow customs clearance to be concentrated at a few sites, it may be possible to effect the same volume of clearance with reduced customs involvement, especially where a dry port is accessed by two or more gateway ports.

(k) *Benefits to sea ports:*

Apart from lowering congestion, the establishment of dry ports also results in reduced handling of goods at related maritime ports. There is a reduction in demand for storage space owing to faster onward transit, saving in both capital costs of providing handling equipment and warehousing as well as in equipment maintenance costs. With greater containerization of transit cargoes, maritime ports also gain the advantage of higher berth through-puts, thus reducing the cost per unit of cargo handled.

(l) *Inventory savings:*

One of the main purposes of the dry ports is to speed up the movement of cargo and to increase the predictability of arrival times. Therefore, dry ports have implications for the volume of goods in transit at any one time, the level of stocks held within a country and the timing of payments for imports and exports. The date on which domestic exporters receive payment for their goods will depend upon the negotiated terms of trading deals.

Owing to uncertainties in transit times and the way in which exchange rates fluctuate, purchase prices of exports from land-locked countries tend to incorporate a risk premium to cover exchange rate fluctuations while the goods are in transit. More reliable delivery and shorter transit time will reduce this risk premium. Rapid and reliable transit enables importers or exporters to hold lower stock levels of commodities. Savings will also be made through the interest that can be earned on the working capital released when lower stock levels are maintained.

(m) *Benefits of unit trains:*

Dry ports encourage the operation of unit trains. The major sources of benefits of introducing unit train operations in place of traditional goods trains are that shunting costs at the terminals and at the intermediate marshalling yards can be avoided and higher wagon and locomotive utilization rates achieved. The introduction of unit trains is most appropriate when freight flows between two points are substantial, fairly continuous and relatively balanced.

(n) *Improved communications:*

Simple, rapid transfer of documentation and information, fundamental to efficient cargo transit, may be achieved by linking the introduction of computerized freight tracking or customs clearance to the provision of a dry port. The benefits are strictly attributable to the introduction of computerized procedures.

With the introduction of a computerized customs charging and recording system, such as UNCTAD's ASYCUDA, incorporating the dry port, benefits may be reaped in the form of a higher ratio of duties collected, fewer unintentional errors through using the wrong calculation factors, quick and accurate automatic summary data compilation for statistical purposes and probably less scope for avoidance of customs duties or malpractice in collection. The computerized information system can also be suitably programmed to furnish important commercial, financial and other informative data needed by customers using the dry ports.

(o) *Additional benefits:*

Many of the benefits of dry ports may be of such a nature that a monetary value cannot be attributed. Benefits which are difficult to quantify, isolate or measure in monetary terms include the following:

- Dry ports enable greater national control to be exercised over transit operations;

- With reduced paperwork and more accurate documentation, there is less scope for confusion or lost papers, fewer delays, reduced cargo loss and better flow of information;
- Importers and exporters may recognize the advantages of greater reliability in the transit routes. (This may be translated into a tangible benefit when importers and exporters switch to the cheaper transit route, or exporters can avert monetary penalties connected with late delivery, or if lower inventory levels can be maintained;
- Finer tuning of cargo-delivery schedules;
- The fewer the transit-transport difficulties, the greater the likelihood of gaining entry into overseas markets with its potential stimulus to other sectors of the economy;
- Creation of a more stable domestic investment climate with reduced transit-transport difficulties for manufacturers depended on imported cargo or already exporting overseas;
- Simplified procedures associated with a dry port and containerization mean fewer steps and fewer officials involved in processing the required documentation. With fewer control points, there is less scope for malpractice. If queries arise in regard to documentation, these can be readily sorted out at a dry port by all parties represented on the site;
- Introduction of simplified work practices at the maritime ports.

D. **The Distribution of Benefits:**

Dry ports inherently involve the activities of both domestic and foreign transport operators, clearing and forwarding agents, shipping agencies, financial institutions, and insurers. When assessing dry ports, it is essential to identify to whom benefits will accrue. Cost savings or additional revenue enjoyed by foreign-owned enterprises as a result of the dry port's operations should not be counted as a direct benefit gained by foreign-owned enterprises, the only benefits which can be considered are those which lead to lower payments for the same services or whose benefits are reinvested or held within the land-locked country with a dry port. The normal procedure open for a government to recoup benefits from foreign-owned enterprises that would otherwise escape from the national economy is to levy additional taxes or alter tariffs. Such pricing adjustment needs to be approached with care as any "penalty" may be perceived as a deterrence to using the dry port facilities, or simply that users may not enjoy any cost reduction which could otherwise stimulate the overall economy.

When considering the introduction of a dry port, a special review should be made in the light of existing terminals for customs clearance, container handling, etc. Locating a dry port in a land-locked country which has no infrastructure would lead to a dry port with the features given in the definition on page 1, e.g. Customs bonded area, warehouse for packing and unpacking containers, facilities for clearing and forwarding agents, etc. One problem is that this might render useless a number of investments already made in the country.
There are several options:

(a) A full dry port may be introduced, superceding all existing facilities which have been developed, by private sector involvement for example.

(b) Use of the existing facilities may continue in conjunction with the dry port, e.g. containers which are not required for internal examination could be released by customs at the dry port, but those requiring examination could be taken to the agents' premises for this to be done. Facilities for packing and unpacking containers would not be provided at the dry port;

(c) Phased introduction of a full dry port could be arranged. Initially option (b) above would apply. As the equipment at existing terminals wears out, it would not be replaced but the agents would in due course move to the dry port;

(d) Government takes over an existing container terminal, paying due compensation for land, equipment, etc., and runs the terminal as a dry port, adding other facilities mentioned in this handbook. In practice this would mean that customs and the dry port operator would be in effect, the same body. This may not be commercially desirable.

A decision in the light of the above options may be taken by a government, depending on local situations prevailing in a given country.

In all circumstance, any assessment of benefits should take into consideration a comparison of what would be the case both **without** the dry port and **with** the dry port, It is essential to consider systematically each of the possible benefits mentioned above and to assess whether, and, if so, to what extent, the benefit may arise from the proposed dry port. Special care is required to ensure that the benefits attributable to the dry port investment package are a direct result of that investment and not attributable to complementary investments, or that changes taking place would not have come about except for the dry port. It is also important to ascertain that the benefits accruing are in the national interest.

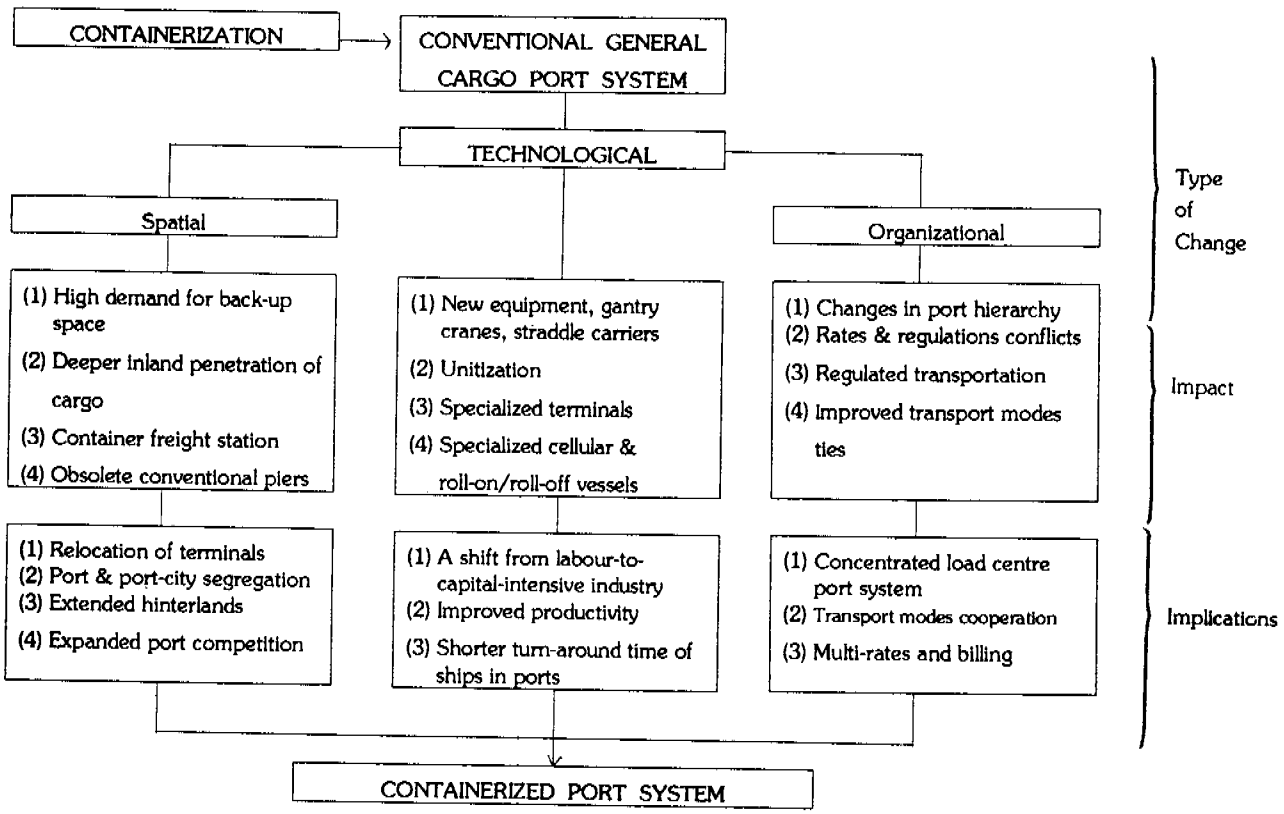
E. **Containerization Defined**

Simply stated, carrying cargo in a container is "containerization". The process is an improvement on the concept of unitization and palletization of cargo for the purpose of making handling easier and reducing costs in transport. The concept whereby cargo is carried in boxes of standard dimensions allows these containers to be handled mechanically, transferred from one mode of transport to another efficiently and without disturbing the actual cargo inside; owing to high unit volume and weight handled per move, the productivity of handling equipment and throughputs is many times greater than if the same volumes of cargo were handled in break-bulk fashion. This advantage, coupled with standardization of the dimensions of containers, has revolutionized general cargo transport and handling

methods. The impact of containerization on the conventional general cargo port system has been set out diagramatically in Figure 2.

The equipment for handling containers in ports and at inland locations has also been standardized. Instead of the wide variety of equipment and cranes used at general cargo ports to handle cargo of different forms, sizes and weights, very few different standard equipment types are needed at container ports. Handling of a "box" of up to 35 metric tons in one lift instead of many different packages in several lifts, means faster cargo handling, which in turn leads to a faster turnaround of the transport units, be they ships, railway rolling stock or road trucks. The possibility of damage, pilferage and loss of cargo during transit, handling and storage is also minimized. Documentation, inventory control and issue of combined transport bills of lading are made considerably easier and more convenient due to reduced paperwork.

Figure 2: **The Impact of Containerization on the Conventional General Cargo**



Source: Hayuth, 1987.

F. **The Benefits of Containerization**

The following advantages can result from containerization:

(i) Facilitation of multi-modal transport owing to ease of transfer from one transport mode to another which takes place safely, efficiently and speedily;

(ii) Complete suitability to door-to-door transport. The container filled in the production centre goes through to the consumption point without any interference with the actual cargo;

(iii) Ease of transport of cargo on a combined transport bill of lading as opposed to the port-to-port practice prevalent for uncontainerized breakbulk cargo. This in itself offers a big advantage to exporters who can get easier bank credits and exact earlier payments for the value of goods shipped, thus improving their cash flow position.

With the probability of non-containerized goods having a combined transport bill of lading having been issued is remote. The inventory of the exporter and capital tied up in goods in transit between the factory and the ports may be reduced.

(iv) Lower risk of damage, pilferage and loss of cargo during transit, intermediate handling or storage. This advantage emanates from the strength of the "box", its sophisticated mechanical handling and the facility of applying seals to the "box". Savings in packing costs accrue when expensive, expendable wooden crates can be replaced by interior cardboard boxes and plastic or synthetic coverings;

(v) Cargo can be sent in "ready-to-sell" or "consumer-ready" condition; for example, garments can be shipped on hungers ready for display in shops, foodstuffs in refrigerated containers can be ready for consumption;

(vi) Speedier cargo handling - One lift of a crane may typically shift up to 25 tons of cargo; cranes can comfortably average 20 lifts per hour if efficiently operated and well-managed. This increases throughput rates while lowering unit costs. With faster handling of cargo, ships and trains can be unloaded and backloaded quickly; hence their utilization is improved. Port efficiency and berth output also increases;

(vii) Reduced amount of covered space for storage of cargo in ports and dry ports;

(viii) Increased utilization of land for storage, as it is practical to stack laden containers up to three high. This implies a general cargo storage capacity of around 60 metric tons per 20-foot (6.096 metres) ground slot at any given point in time.

(ix) Easier inventory control and cargo tracking at terminals owing to the ease of identification of containers - All identification numbers are computer-compatible. This also helps in communication: Real-time, on-line inventory controls can be applied to containerized cargo. There are numerous other advantages that accrue to the shipping sector and ports. The resultant economies may in turn be passed on to importers and exporters at the inland location. In addition to direct benefits, there are also several indirect benefits, such as;

(1) *Trade facilitation:* small inland entrepreneurs far away from ports and leery of complicated, protracted procedures may shy away from exporting their goods. With the port infrastructure at their doorstep, where all the agencies involved in export clearance and promotion are located under one roof, many smaller producers of goods may be motivated to export.

(2) *Improved use of transport capacity:* Owing partially to the compactness and standard size of containers, but more especially to the speed with which containerized cargo can be loaded and unloaded, more cargo can be carried per vehicle in a given period of time.

(3) *Road congestion alleviation:* Since one container load makes better use of truck capacity, the potential number of commercial vehicles on roads can be reduced. This in turn may save on haulage and road maintenance costs, although this factor is heavily dependent on transhipment facilities and vehicle turnaround times.

(4) *Customs facilitation:* Customs may be satisfied with a simple check of the container's exterior surface and seal. A second level of check may be of a sample of packages within the container. Only in the case of "full turnout", or a thorough check, should customs examination be as time-consuming and labour-intensive as it is in the case of conventional break-bulk general cargo operations. In the interest of efficiency of door-to-door transport, it is not desirable for full customs inspection to be carried out more thoroughly than is absolutely necessary. A box sampling procedure (either random or based on past records of a security breach) should be employed by customs when selecting containers for inspection. Containerized cargo should, on average, be processed much more rapidly by customs than cargo in break-bulk form.

(5) *Improvement of inland distribution systems:* Those systems which are geared to containerization stand to be more competitive in an international trade context. This development may, in turn, contribute to the buoyancy of the national economy and to the international standing of the country.

G. **The Growth of Containerization**

In the developed countries there has been inland transport of containers since they were first introduced. Sea-Land Services started as a trucking company sending containers overseas, in effect simply an extension of inland transport. In Europe, however, widespread land transport of maritime containers generally gained in use after sea transport had started; thus a development took place quite similar to the one now seen in certain developing countries.

The main container port in Europe has been Rotterdam (The Netherlands). While, in 1971, some 31 per cent of incoming general cargo and 35 per cent of outgoing cargo was containerized, in 1979 this had increased to 65 per cent and 85 per cent respectively. By the year 2000, the port is expected to handle 100 percent of general cargo in containers. In comparison, the percentage of containerization of general cargo in some developing countries is still less than 30 per cent; Annexes I to III illustrate the explosive rate of growth in containerization, especially in developing countries. Hence there is an urgent need for these countries to plan and organize this development in such a way that they get maximum benefit from this new system of transporting cargo.

The next stage in containerization is development of inland clearance facilities, partly to relieve congestion in the port area stemming from the high rate of growth of containerization, and partially to rationalize the pattern of movements inland. These Inland Clearance facilities, or Customs Depots, have become known as dry ports or ICDs.

CHAPTER I - Dry Ports: Operational Procedures

A. Basic Functions and Activities

Activities, procedures and operations in the dry port may be divided into the following main groups:

(a) Receipt and despatch of cargo;

(b) Truck operations;

(c) Loading/unloading of cargo/containers to and from trains;

(d) Customs clearance;

(e) Gate checks and security;

(f) Storage of cargo and containers;

(g) Container repair;

(h) Information flow and communications;

(i) Record keeping and data storage;

(j) Billing and cash collection.

Against this framework, it is useful to have a clear-cut conceptual plan for the activities that are to be performed, laying down the sequence of operations. This sequence should, of course, be as simple as possible; duplication of activities and delays should be avoided. The operations of the dry port revolve around the following centres or activity:

- *The rail siding:* the place where containers are loaded on and unloaded off trains. Arrival and despatch of trains also takes place at this location.

- *The container yard:* the place where containers are stacked prior to despatch by rail or prior to delivery to the customer.

- *The container freight station (CFS):* the area where containers are packed and unpacked and aggregation/segregation of cargo takes place.

- *The Customs examination bay:* the designated place where containers are placed for examination by customs. The sequence is described below. The basic functions of a dry port is to receive import containers arriving on trains, to unload and stack them, inform the importer, carry out the customs examination, and after completion of paperwork, load the container onto a road vehicle for delivery to the importers' premises. For exports, containers usually arriving by road vehicle are stacked and upon completion of export customs formalities, are despatched by rail to the sea port with a combined transport document (CTD) issued by the shipping line or combined transport operator, also known as a multi-modal transport operator. All charges are collected at the dry port; likewise all paperwork is completed at this point and the exporter/importer needs to do nothing at the sea port.

Dry port operators' activities connected with imports

- Reception of train from seaport	- Receive advance train manifest from port
- Recording of containers on train, making comparison with manifest	- Inform railway/port authority of any discrepancies
- unloading and stacking containers	
- FCL containers are loaded from stacks onto road vehicles	- Present cargo at customs bay for examination after the importer has filed papers
- LCL containers are taken to CFS unpacked, returned to stacks	- Segregate cargo; present it to customs
-Collection of charges due on container and cargo	Issue receipts
- Preparation of gate pass for removal of containter/cargo	- Check that customs cleared goods
- Check at gate: condition of container and cargo; correctness of removal	- Record condition; get acknowledgement
- Filling of the record of the transaction	

Dry port operators' activities connected with exports

- Reception of cargo/container from factory	
- Gate check on condition of cargo/ container	- Record condition; check if export control regulations allow shipment
- Presentation of documents by exporter to customs	- Customs examination and clearance; sealing of containers
- FCL container to stack	
- Break-bulk cargo to CFS	- Place empty container at CFS; make up aggregation of cargo in container
- Removal of container from CFS stack	- Issue combined transport document by the shipping line or the combined transport operator
- Preparation of train manifest, i.e. details of containers to be loaded onto train	
- Stacking of containers in proper order for loading	- collect charges due
- Issue a railway receipt for each container	
- Load containers onto train	- check seals
- Transmit train manifest with details of containers to sea port	
- Record all transactions	

B. **Container Transport, Lifting and Stacking**

The following procedures should govern the reception and despatch of trains:

(a) Trains should run on a fixed schedule: the timing of their arrival and departure should be specified and monitored; schedules should be vigorously kept, both at the sea port and dry port. The transit time should be monitored. The paths of these trains should be indicated in the railway timetables of all the railway systems concerned.

(b) Places should be allocated for incoming trains on the rail siding, preferably with morning arrival so that all the formalities of delivery can be performed the same day.

(c) The system or checking seals and the condition of containers by the dry port operators, the railway and customs should be clearly specified.

(d) A system of train examination should be laid down so that containers are not detained at any intermediate points; prior information should be available to dry ports as to any wagons that are not to be back-loaded. Major repairs to wagons should be done outside the dry port. Only those minor repairs which are absolutely necessary should be made in the dry port.

The procedure for loading and unloading containers should take account of the following considerations:

(1) The container stacks should have sufficient leeway and not be squeezed to capacity, otherwise crane productivity will suffer and the number of moves involved in retrieving a container will increase.

(2) Container stacking should be done in such a manner that imports, exports and empty containers are clearly separated and identifiable. Special care should be taken or those holding dangerous cargo which, like refrigerated containers, should be stacked separately.

(3) Refrigerated containers should have priority in unloading/loading operations and should be immediately put on reefer points to avoid heating.

(4) Streams of road vehicle traffic shuttling between rail siding and stacks should be well organized so as to avoid accidents. The same applies to movements between the stacks and the container freight station.

(5) Import and export consignments should be stacked separately so as to avoid confusion and subsequent delay.

(6) Packing of containers should be done carefully in order to ensure rational utilisation of space inside the container.

(7) Availability of sufficient empty containers at the container freight station (CFS) and the utilization of shed space should be monitored.

(8) Very careful recording should be done of packages loaded into a container or taken out of a container.

C. **Gate Procedures and Container Control**

Customs laws and procedures are explicitly for each country. The dry port and transport operations should conform to national laws. Control of vehicles should include checks on their roadworthiness It is of paramount importance that cargo and container transport

comply first and foremost with the laws of the given country so that high levels or safety and security are maintained.

The gate has a crucial function; it is the first interface with users. The gate clerk performs the gollowing tasks:

(a) Checks export/import documents;

(b) Checks delivery/receipt instructions or waybill;

(c) Fills gate log and notes particulars of vehicles;

(d) Inspects the container seal and the weight recorded;

(e) Prepares equipment receipt (ER) and gets drivers' signatures. (The equipment receipt (ER) is the document describing the condition of the equipment [container]);

(f) Indicates container location to the driver;

(g) Prepares inventory reports.

The main function of dry ports being receipt, despatch and clearance of cargo (mostly in containers), the need for an up-to-date inventory control and tracking system is paramount. Importers prefer to have their containers located and delivered quickly. Exporters want to be able to despatch containers at short notice. The management of dry ports has to ensure that each export container is classified, located and loaded onto a specified train. This means that each functional unit of the dry port, be it the rail siding, the Container Yard (CY), the gate or the CFS, must have on-line, real-time information about all the containers in the dry port, as well as those expected on a given day and those in transit between the sea port and the dry port. This knowledge is essential not only for customers but also for dry port operations, as all planning of trains, container yard stacking and the function of container freight stations depend on this information.

Earlier a cardex system was used at smaller terminals; each container was described on a card using separate colours; changes in the status of the container were noted step-by-step, namely unloading, stripping, empty, etc. The use of such cards, however, was confined to inventory control and statistical purposes. Their effectiveness in planning operations was marginal.

With computers, the job has now become quite simple. From the time of receipt of advance information about incoming containers (both from sea ports as well as from local exporters), to the despatch of the containers, a real-time, on-line inventory is maintained. A clear picture can be obtained of all containers on hand and expected. The physical condition of containers can also be monitored; the quantity ready for despatch, any which are damaged, those which are due fur customs examination, and the quantity for the CFS, etc. can be determined. This information affords better utilization of capacity, more accurate train marshalling, better customer service, and ultimately a more competitive standing for the dry port. So as to attract customers away from traditional fragmented methods of transport, the dry port will have to offer good quality service at competitive prices. Just In Time (JIT) inventory systems are becoming common. They allow for savings in costs which are made possible by the reduction of stocks as a result of containerization. For this to work well the importer must know the container's expected date of arrival in advance. The following procedure makes this possible:

1. The sea port must send a copy of the ships sub-manifest to the dry port at least a day before the vessel docks at the sea port; this information should include the container number, the consignee, the consignor, the commodity and weight. Normally sea ports get notification of ship arrivals sufficiently in advance to allow for this information to be passed on to the dry port. This information can be sent by courier, telex, fax or by electronic data interchange (computer to computer).

2. With regard to export containers the dry port should send similar information to the sea port.

3. On receipt of information from sea ports, the dry port must inform the consignee by phone or fax, giving all available details including expected date/time of arrival. The actual arrival time must be reconfirmed.

4. Sea ports may inform the dry port of the scheduled departure time of the vessel on which export containers from the dry port must be loaded.

5. The railways at the sea port and dry port must exchange details of train manifests before the departure of trains. This should include individual wagon numbers, container numbers on each wagon, total loads and any mention concerning cargo needing special attention, namely dangerous or refrigerated cargo, etc.

6. The clearing and forwarding agents of shipping lines must give prior planning information about expected import and export containers; this should form an additional source of information for dry ports.

When cargo handling operations have been streamlined, it follows that invoicing must also be streamlined. The items charged should be as few as possible. Ultimately, the door-to-door freight rate should include:

(a) Ocean freight rate;
(b) Rail freight rate;
(c) Container lifting;
(d) Storage of containers;
(e) Consolidation and organization of cargo;
(f) Storage of cargo;
(g) Customs inspection and duties;
(h) Road transport;
(i) Ancillary operations, e.g. sorting and internal shifting of containers.

A suggested flow of cargo and its accompanying documentation is presented in Figure 3 on page 22. A successful dry port may bring about a reduction in the through-transport rate per box compared to alternative cargo routes.

It is the job of the Mult-modal Transport Operator (MTO) to organize the door-to-door transport of goods; a detailed list of the tasks to be undertaken is given in Annex IV.

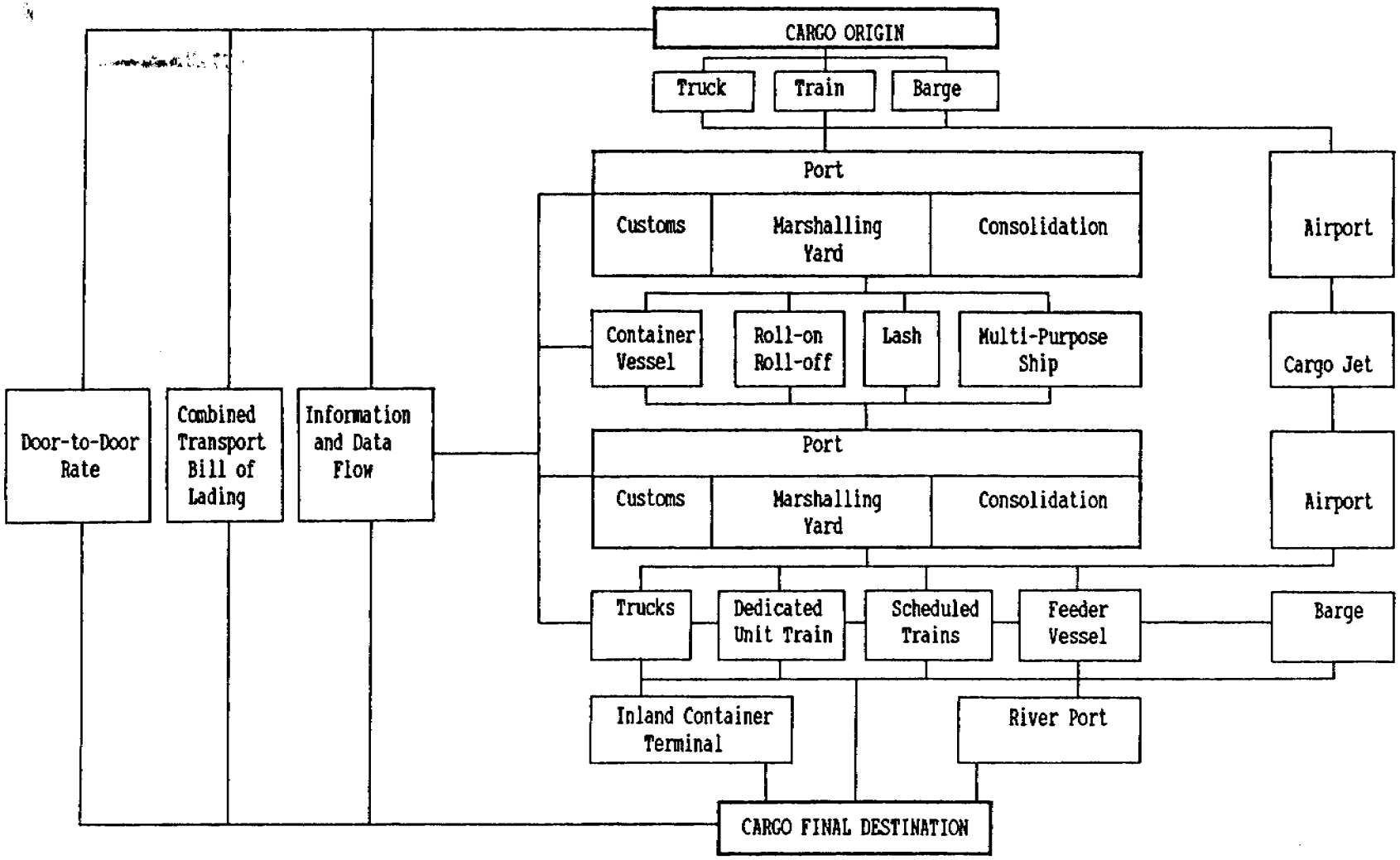
D. **Transit Transport and Customs Regulations**

International multimodal transport aims at reducing transit time and cost. Unless customs procedures are simplified, however, the potential advantages will not be realised. This is particularly so when the cargo concerned crosses several international boundaries. Many attempts have been made to simplify and standardize customs formalities which otherwise may constitute a barrier to trade when their complex nature and diversity restrict commerce.

Developed countries have usually solved most customs problems affecting transit by ratifying modal conventions on a multilateral basis whereas developing countries largely depend on bilateral or sub-regional agreements. The first substantial proposals for simplification were sponsored by the International Congress of European Traders. They were put forward by the International Chamber of Commerce for consideration by the League of Nations between the two world wars. The outcome was the International Convention for the Simplification of Customs and other formalities, in 1923, the first concrete result obtained.

The General Agreement on Tariffs and Trade (GATT), 1947, also contains provisions which represent progress in the same direction. Progress in Europe on the harmonization of customs matters, particularly nomenclature and valuation, led to the establishment in 1950

Figure 3: **A Schematic Flow Chart of Cargo from Origin to Destination**



Source: Adapted from Hayuth (1987).

of the Customs Co-operation Council, which has continued and expanded that work. A great deal of co-operation has been undertaken under the auspices of the United Nations.

Traditionally, when goods crossed the territory of one or more states in the course of the international carriage of goods by road, the customs authorities in each state applied national controls and procedures. These varied from state to state but frequently involved:

(a) Inspection of the load at each national frontier,

(b) Imposition of national security requirements (guarantee/bond/deposit of duty) to cover the potential duty and taxes while the goods were in transit through each territory.

These measures, applied in each succeeding country of transit, involved considerable expense, delay and interference with traffic.

It should be noted also that international carriage of goods by road must take account of all relevant regulations at the national level. Maximum gross vehicle weight, axle weights as well as vehicle length and height limits often vary from one country to another. This must be taken into consideration so as to ensure the smooth flow of goods across international boundaries. Similarly, vehicle operators should be familiar with any periods of the day, week or year when road haulage is not permitted; certain road or routes may be off limits for heavy vehicles.

In an attempt to reduce the difficulties experienced by transport operators, while offering customs administrations an international system of control which could replace the traditional national procedures while still protecting effectively the revenue of each state through which goods are carried, a number of international customs conventions have been introduced over the past 40 years. Trading terms have been amended and simplified (see for example Annex V).

Since goods in transit are not intended for consumption in the transit country, special customs arrangements constituting a customs transit procedure can be applied to such goods. The purpose of the various customs transit procedures is generally to provide evidence that the goods have not entered either wholly of partially the market of the transit country without duties and taxes being exacted.

As a general rule, customs regulations do not distinguish between goods moving under multi-modal transit arrangements and those moving under uni-modal contract terms. Customs requirements are roughly the same in both cases. From the customs point or view, the basic difficulty posed by transport and goods in unit loads is that they transit faster and

the goods themselves cannot easily be physically examined since the unit loads are not unpacked at intermediate points. In such circumstances, traditional customs formalities at the frontiers would constitute a hindrance to trade.

The basic customs transit procedures is the national procedure which is subject to national law and involves the use of national documentation and national guarantees to ensure payment or any import duties and taxes chargeable. Beyond national procedures, there are international customs formalities which have been developed. Some of the international instruments have been prepared under the auspices of the United Nations. The basic aim of such agreements is to provide procedures whereby the goods may pass through a number of countries with the minimum of customs control during the journey and without the need for national documentation and national guarantees. National documentation and national guarantees are thus replaced by an international declaration and international security arrangements respectively.

Movement of goods through several transit countries involves customs transit formalities in each of them. The basic requirements in a transit country is that the person concerned with the transit procedures submit to the customs offices at the points of entry and exit a transit document describing the goods and the journey. Further, the Customs administration will also wish to verify material security measures undertaken by the initial customs office before departure of the goods; this includes checking identification marks and seals on containers and vehicles.

The customs transit formalities in any given country for all kinds of transit are essentially simple:

(a) The customs office of departure retains one copy of the transit document in order to be able to follow up the operation;

(b) The carrier receives a duplicate copy for eventual presentation to the customs office of destination where the shipment will be checked.

If the conditions are fulfilled on arrival of the shipment, the transit document is sent back to the office of departure, which cancels the guarantee. This operation is essentially the same in all countries, except that some countries call for more copies of the transit document than others.

Where a group of countries is under the umbrella of a more specific agreement (for example, a Customs Union), simpler procedures may be used. The customs office in the country of destination sends the customs transit document back to the office in the country of departure

to complete the operation. Formalities and control at the intermediate border points are thereby simplified.

Regionally or sub-regionally limited customs agreements can provide workable solutions as long as transport operations are confined to countries that are members of such agreements, but there is an inherent danger of multi-modal transport operators having to cope with border delays if more than one such agreement prevails. Complex and varying customs procedures and transit regulations lead to extensive delays for trucks and trains at border stations and the necessary infrastructure has to be provided for this. Especially in rail transport, long stops at the frontier may lead to congestion at railway stations or marshalling yards close to the border, quite possibly also adversely affecting national transport operations. Container transport, which offers the possibility of moving customs controls to inland points and specifically to dry ports, can help considerably to ease the situation at borders. By making optimum use of the existing infrastructure, the need for new facilities can be reduced.

The speed of transit depends largely on what has been done in the country of departure. If reliable and adequate information concerning the goods and their planned route has been determined and incorporated into the appropriate documents, the checks have been properly carried out, and physical security measures taken, the task of customs clearance in the countries to be crossed by the shipment is much easier.

As for the clearance of the goods in the country of final destination, the effectiveness of the door-to-door transport operation depends to a certain extent on the choice of the place where the clearance of the goods is to be performed in the country of destination.

The best way to tackle the problem of improvement of customs procedures is through simplification and harmonization of the documents required. Also valuable are special agreements between the customs administration and importers and exporters in countries of shipment and destination. Such agreements establish procedures for quick clearance of shipments, mainly relying on commercial documents which accompany the shipments, the control being completed by customs on the shippers' or the consignees' premises. Such methods are typical of developed countries.

Broad areas where measures to facilitate the flow of goods in transit should be taken by countries of shipment and destination of goods have been identified in the Multi-modal Transport Convention. The two subjects singled out for attention are:

(a) Adequacy of information to be provided in the country of shipment, and

(b) The place in the country of destination where the inspection of the goods is to be carried out.

In the case of cargo transiting via a dry port, the need for customs control is greater than for the national trade of goods, as normally none of the parties concerned with the transit operation (shipper, consignee, carrier) has an office in the transit country which could intercede should irregularities be detected.

The principle of freedom of transit is established in various international instruments such as the Convention on Freedom of Transit (Barcelona, 1921) and the Convention on Transit Trade of Land-locked Countries, 1965. However, most of the customs transit regimes provide, directly or indirectly, for the right of a national customs administration to examine goods crossing any point in the national territories, e.g. for security or public health reasons.

The principle of exemption of goods in transit from import and export duties and taxes has been well recognized. It has been reflected in international agreements. The situation may he complicated, however, by requirements for payment of various dues and charges to cover useful services rendered. Reasonable dues may be justified to provide appropriate economic reward to the transit country in connection with customs transit operations. In order to facilitate multi-modal transport operations, under the Convention the following are possible:

(a) Fees and charges may be levied under national regulations for public security or health reasons; and

(b) Fees and charges may be levied limited to the approximate cost of services rendered, provided they are imposed equally and without discrimination.

Customs control is usually composed of two elements:

(1) A requirement for a financial guarantee or bond to be established in the transit country by the party responsible for the transit operation in order to meet possible claims by the customs; coupled with

(2) Physical measures taken by the customs to verify that the transit goods are eventually re-exported.

Under the TIR system of guarantees, each contracting party designates a national association which undertakes to act as a guarantor for all TIR carnets that have been issued by the association itself or by associations of other countries parties to the TIR Convention. These associations form a chain in which members are linked through an international organisation, which is the International Road Transport Union (IRU). It is imperative that the operation of a proposed dry port accommodate cargo guarantee systems.

SECTION TWO

MODELLING, PLANNING AND OPERATING A DRY PORT

CHAPTER II: Dry Port Modelling and Locational Analysis

Introduction

Several factors should be considered in any analysis or the optimal location for a dry port site:

1. Traffic flows between inland centres of production and consumption and the ports. These flows should be analyzed with reference to:

- commodities
- directional split: imports/exports
- proportions of less-than-container-load (LCL) and full-container-load (FCL) boxes
- Percentage of containerizable cargo
- forecasts of future growth in trade flows
- relative locations of inland centres.

2. Modes of transport available and respective network and corridor capacities.

3. Possible reduction in ton per kilometre or box per kilometre costs with the introduction of a dry port and the consequential reduction in related unit transport costs.

4. The actual functions of the dry port which normally include:

- packing of LCL export containers;
- unpacking of LCL export containers;
- reception/delivery of LCL cargo by lorry;
- loaded container storage (LCL and FCL, import and export);
- railhead/shunting operation;
- provision of full customs clearance facilities for LCL cargo and FCL containers;
- provision of office space for relevant commercial activities;
- provision of cargo and container handling equipment (most commonly a selection or combination of fork lift trucks, rail-mounted gantries, rubber-tyred gantries and front-end loaders);
- provision of appropriate security;
- provision of adequate communications facilities.

5. Transport infrastructure in the vicinity or the proposed site.

6. Existing ancillary transport-related services in the vicinity of the proposed site.

7. Scope for future site development or expansion.

A. **Methodology: the Origin - Destination Approach**

Analysis first requires the assembly of the origin-destination (O-D) matrix for traffic flows for a base year. This should be done for both imports and exports and for movements between inland centres and ports for each relevant commodity. For the set of flows thus generated, total ton-kilometre flow should be calculated. Account should be taken of cargo which is currently containerizable.

With the introduction of one or more dry ports, the total ton-kilometre distance and box-kilometre distance may be reduced. This is vital as routing of cargo through a dry port automatically introduces double-handling and therefore possibly higher total handling cost per box on an origin to destination basis. For the dry port to be economically viable the reduction in total transport cost must outweigh any increase in handling costs.

From the possible sites under consideration, as a starting point, those sites which yield the greatest reduction in total ton-kilometre or box-kilometre flow are the best ones for locating a dry port. If two or more sites produce similar reductions in the total tonne-km calculation, a second stage analysis is necessary. Each site should also be evaluated from the point of view of road/rail accessibility, land value, site configuration, ease of land acquisition, drainage/geological suitability, local industrial activities, existing local transport services and scope for future site development.

The existence and proximity of an urban ring road is particularly useful for local cargo distribution. The basic locational options are illustrated in Annexes VI and VII.

B. **Data Collection Procedure**

The data required for carrying out appropriate locational analysis can be obtained from the following sources:

(a) Secondary sources including data collected periodically or systematically by ports over the preceding years, for in-house purposes or for submission to relevant government departments.

(b) Field observations, including data collected internally with a specific objective in mind or by an external team commissioned for the task. This would require using a proper sampling procedure. Careful analysis at this stage is vital so as to avoid or at least minimize error in the estimation of demand for a projected dry port facility .

(c) Output from forecasting models.

Locational analysis based on secondary sources has two main weaknesses.

(1) Accuracy is dependent on the reliability or the original data, which could be surprisingly low,

(2) Flows may be aggregated such that the traffic flow data are of limited value for dry port site selection.

The best analyses are based on real-time data collected from field observations structured overtime and space. The data format should be based on the origin-destination matrix shown in Figure 5, for imports.

The tonnage flows for each O-D cell should be recorded for each commodity and, separately, for a number of months or years, as appropriate, and in accordance with data availability.

C. **Sampling and Data Analysis**

The collection of data for each flow on a full population requires considerable resources. For all practical purposes, a sampling procedure for data collection based on an O-D format must be used. The following procedure should be adopted:

1. For each O-D cell sample, tonnage figures under each commodity for imports and exports should be recorded. The figures should then be compared with the total tonnage figures of the same commodity for the base year. Appropriate multiplication factors should be applied to the import and export flows, respectively.

2. Individual multiplication factors should be computed for each port and each commodity stream. The streams are based on particular transport routes or corridors within the overall network.

3. Using the appropriate multiplication factors applied to the sample tonnage data, total tonnages by commodity are computed for each stream for the base year.

4. Based on an assessment of the containerizability of different commodities or commodity groups, the quantities of cargo projected to move between the dry port and the relevant gateway ports are generated.

5. The actual movement of cargo in number of containers from these origin-destination flows may be calculated as a percentage of total containerizable cargo for each flow.

6. An assessment of the balance between LCL and FCL containers is made for the base year and for future years.

Figure 4: **Format for Origin-Destination Analysis of Traffic Flows (Exports)**

Year = Y_1 Commodity = C_1 Export

	Port D_1	Port D_2	Port D_3	... Port D_n
Inland Centre O_1				
O_2				
O_3				
O_4				
O_5				
O_6				
O_7				
O_n				

Figure 5: **Format for Origin-Destination Analysis of Traffic Flows (Imports)**

Year = Y_1 Commodity = C_2 Import

	Inland Centres						
	D_1	D_2	D_3	D_4	D_5	D_6	... D_n
Port O_1							
Port O_2							
Port O_3							
Port O_n							

7. Forecasts of flows should be based on econometric modelling of future economic conditions; track-generation forecasts should be carried out for traffic over the next 10 or 20 years. A range of forecasts should be calculated based on both optimistic and pessimistic assessments of trade flow.

8. Viability of the projected dry port may be assessed under a range of economic conditions.

9. Sensitivity of cargo flows through the dry port to changing circumstances may be assessed by checking the impact of altering one or more variables within the econometric model of cargo throughput and dry port revenues.

D. Impact of a Dry Port on Total Ton-Kilometre and Total Transport Costs

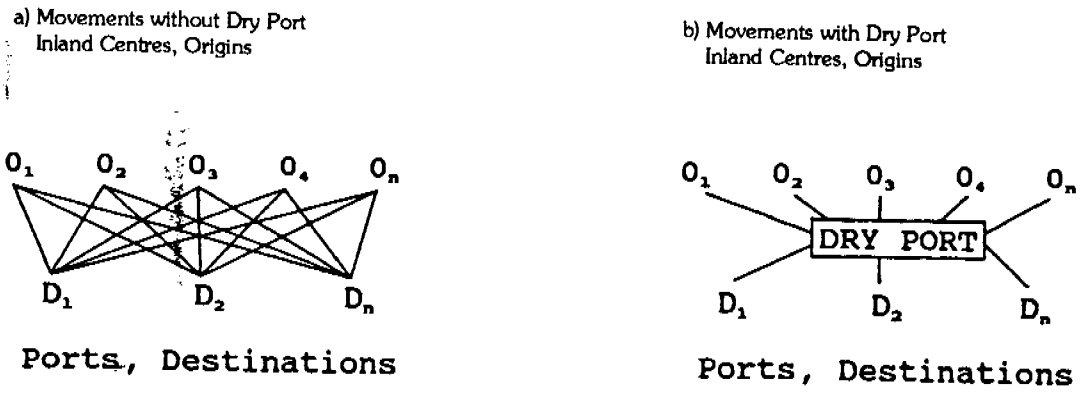
Using the data from Figures 4 and 5 on tonnage and distance between each origin and destination, total ton-kilometre estimates for the base year may be calculated. The reduction in total ton-kilometre costs attributable to the introduction of a dry port must be evaluated very carefully as any reduction on one side of the equation may or may not outweigh the additional costs incurred in the double handling of cargo routed through the dry port. The reduction in aggregate movements is represented diagrammatically in Figure 6.

A number of possible sites for locating the dry port should be considered on the basis of ton-kilometre calculations. Each site must then be evaluated with reference to its adjacent transport infrastructure general accessibility, shape, size, and overall potential for development.

E. The Transport Network

Capacities of the regional road and rail links should be calculated and the probable pinch points and bottlenecks identified. If restrictions are sufficiently serious, they should be tackled promptly. Rail transport requirements must be evaluated in terms of size, number and frequency of block trains to be scheduled. It is necessary to balance service frequency with average load factors both into and out of the dry port. In terms of final site selection, it is essential to reach to a compromise between spatial efficiency and constructional operation and maintenance costs of a projected dry port. Regional transport network capacities significantly affect the spatial efficiency of the overall distribution system involving one or more dry ports.

Figure 6: **Reduction in Ton-Kilometre Movement with the Introduction of a Dry Port**



NOTE: Export routing is illustrated, thus inland centres appear as origins and ports as destinations.

The quality of a transport network may be evaluated using the following criteria:

- Centrality
- Road/rail connectivity
- Network shape
- Spatial centre of gravity.

(i) *Centrality* as a criterion would enable a potential dry port site to be evaluated in terms of its position relative to that of existing inland production and consumption centres and ports. One of the methods which can be used to assess centrality involves the use of Koning numbers. It is assumed that origins and destinations in a network are vertices while the road/rail linking them are edges (see Figure 7). The numbers represent the total number of edges which must be travelled along in order to reach each of the vertices from the most distant location. Separate Koning numbers may be computed, respectively, for road and rail centrality. For locating a dry port, the lowest number gives the best site from the point of view of centrality.

(ii) *Connectivity* of a transport network is given by index B (Beta). This is expressed as follows:

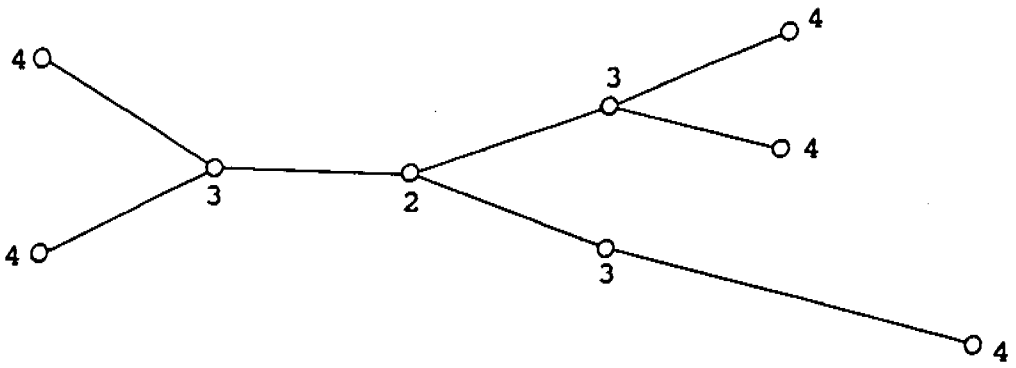
$$B = \frac{\text{Total number of edges (road/rail links)}}{\text{Total number of vertices (inland centres and ports)}}$$

A value of B above 1.00 implies good connectivity; a B value near 3.00 is indicative of a complex, well-developed network having excellent rail/road links.

(iii) *Network shape* may be assessed to give an indication of the location of a dry port with reference to lengths of the paths or transport corridors linking it to relevant production and consumption centres. The ratio of the total length of the transport network (kilometres) to the index of shape. Values above 10 are most desirable for a dry port location.

(iv) *Special centre of gravity* enables the size of centres of vertices to be weighed according to their population, industrial production, consumption or other measures of attractiveness or output. The closer a dry port is to the centre of density of a defined region, the better located it is in terms of regional container and cargo distribution requirements.

Figure 7: **Use of Konig Numbers as a Measure of Centrality**



Source: Haggett, P., Cliff A.D. and Frey, A. (1977) Locational Models and Locational Methods, Arnold Press

F. Unit Cost Minimization with Dry Ports

The introduction of a dry port in a multimodal transport system in a developing country is normally part of a series of practical and administrative measures taken to re-gear the existing transport system to get the most out of containerization. Rapidly growing economies typically absorb large volumes of consumer goods as well as the hardware and machinery required to fuel, service and satisfy fast growth. A high proportion of goods, mainly derived from developed countries, is containerized.

The widespread problem of port congestion, stemming from accelerating volumes of cargo moving ship to shore as well as inadequate storage capacity, has prompted many countries to seek solutions based on the inherent advantages of containerization and container transport systems. The dry port, therefore, is often viewed as making two major contributions: (a) bringing about a reduction in door-to-door transport unit costs; (b) removing customs-related activities from the sea port and hence accelerating cargo passage through the seaport, thus, in turn, reducing pressure on over-burdened storage yards.

The commercial success of a dry port, however, ultimately depends on: (a) levels of cargo throughput relative to the facility's capacity and the volumes of cargo moving by road, rail (or inland waterway) without the dry port; (b) the facility's effect on increasing the efficiency of the door-to-door through-transport system; (c) the ability of the dry port to yield overall transport costs which are lower than the total of transport charges incurred over alternative routes.

Some of alternative cases of transport costs have been modelled in Figure 8. It is assumed in the model that terminal costs incurred in moving containers on/off lorries, from lorry to rail and from rail to inland waterway are roughly the same on a unit cost basis. It is assumed that terminal costs incurred in port are approximately double the inland handling costs per box, since almost invariably containers are stored temporarily at the seaport before onward transmission; they are thus double-handled. In contrast, road-rail transfer is more frequently direct. It should be noted that the slope of the transport cost curves, and the representation of the costs incurred in transferring containers between modes can be readily adjusted to suit a particular case of door-to-door transport. Handling rates (assumed to reflect costs) obtained from intermodal box movements for the River Rhine (Lloyd's List, 23 February 1990) would appear to confirm this assumption.

Figure 8: **Door-to-Door Freight Transport Costs, Alternative Cases**

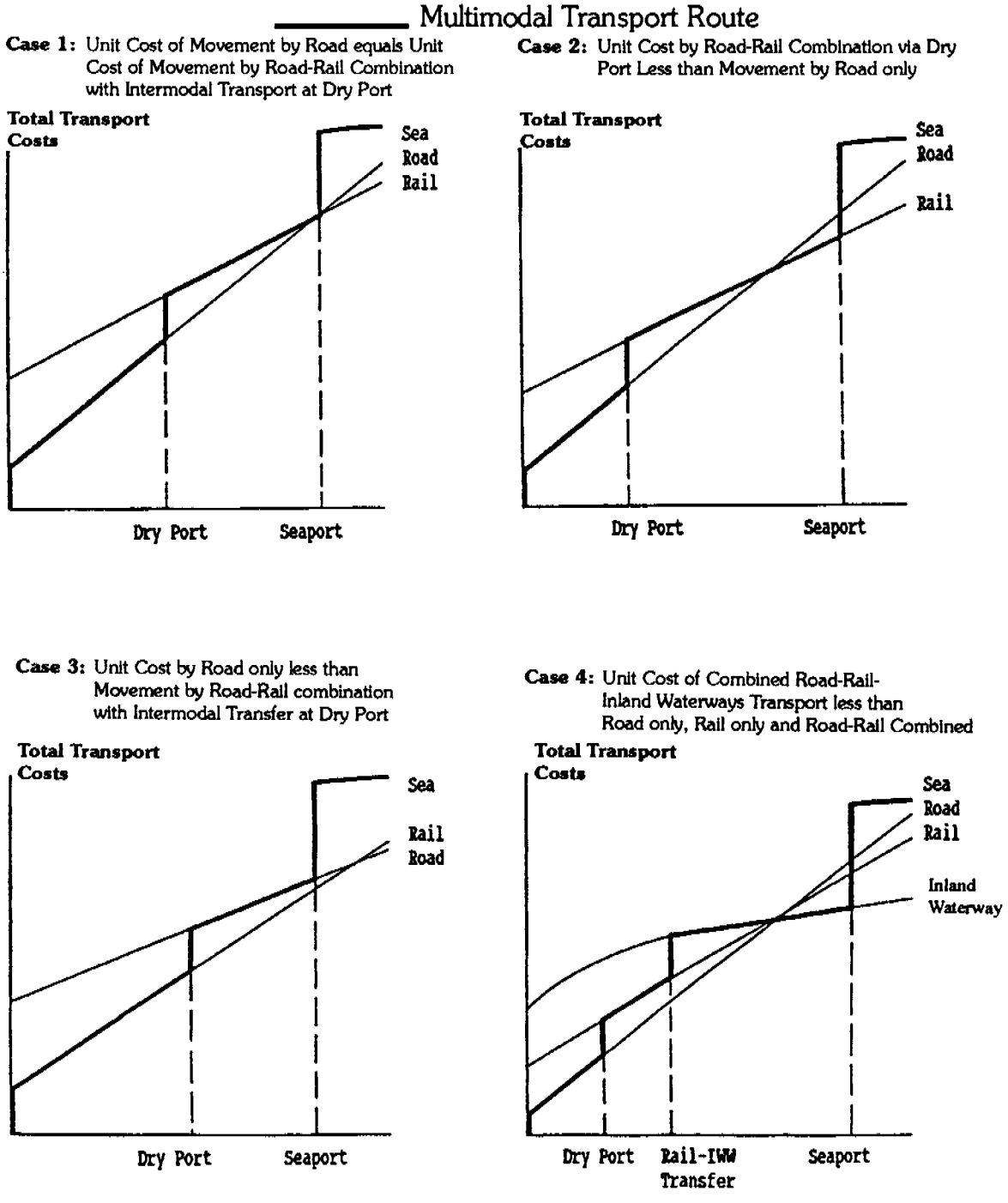


Figure 8 shows that:

(a) The additional handling cost incurred at the dry port must be more than offset by the benefits of exploiting the qualities of two or more modes of transport for the dry port to be viable in the long-term. In practical terms, because, in most countries, the road network is more extensive than the rail network (consequently containers almost always move by road at some stage in the door-to-door transport sequence), the choice is normally between the road - dry port - rail route and the road-only route.

(b) The location or the dry port is critical since it affects both the relative unit costs of door-to-door transport options and the viability of the facility; this stems primarily from its ability to be price-competitive against other options.

G. **Container Transport and Distribution**

(a) *Rail*

The most economic system for rail transport is the "block train" or "unit train" system. Unit trains give the highest quality rail service for the lowest costs provided that cargo flows are regular and balanced. In a dry port, such unit trains form a very important transport unit and their regular scheduling and reliability to and from the ports is absolutely essential. Trains may consist of a number of flat-cars carrying containers and running on fixed, regular timetables. The dry port manager must ensure that loading and off-loading of containers is done expeditiously and that the dwelling time of containers is minimized. Likewise, the manager will have to co-ordinate with the maritime port and railway system so that cargo in containers gets despatched on the scheduled ship mentioned in the through bill of lading from the dry port. In many dry ports, the arrival dates and timings of cargo are prominently exhibited for the benefit of customers.

(b) *Road*

Road transport initially dominated inland container transport in the industrialized countries, mainly owing to its flexibility and speed. One of the reasons for the success of the truck in container transport in industrialized countries was the availability of a high-quality road system. In developing countries, the poor quality of roads can often be a major drawback for road haulage of containers. In order to investigate the possibilities of inland transport of containers by road the existing or planned road infrastructure should be carefully studied together with the availability of specialized vehicles and their organization. Inland transport

of containers by road calls for the existence of minimum standards of road construction and specialized vehicles. Those minimum standards are determined by the weight and dimensions of the containers to be transported.

For containers to be moved by road, the existing or planned infrastructure must meet minimum requirements in regard to:

- Lane width and number of lanes;
- Maximum gradients;
- The minimum radius of all bends and curves;
- Maximum permissible height of vehicles;
- Maximum permissible axle loads;
- Maximum permissible gross vehicle weights.

The smooth movement of containers by road usually requires the existence of roads that have at least two lanes. The individual lanes should have a width of at least 3.5 metres so as to accommodate container carrying vehicles safety, which means a total road width of at least seven metres. The lateral clearance of overpasses and tunnels required for container transport by road depends both on the height of the vehicle and the height of the container, allowing for an operational safety margin. The height of the loading platforms on European-produced trucks and semi-trailers is usually 1.4 metres. Overall vehicle height is limited to 4.0 metres except in the United Kingdom where the limit is 4.2 metres.

Another important factor in relation to the construction of the road is axle load limits, which are, in many cases, an obstacle for container transport by road in developing countries. Depending on the road surface, type of container carried and the number of axles, an axle load of 8 to 13 tons is permissible. Table 1 gives the relationship between axle loads and container-carrying capacity for roads sustaining axle loads of 8, 10 and 13 tons. Maximum gross vehicle weights typically range from 25 to 32 tons in developing countries (implying a maximum payload of about 18 to 25 tons) and from 38 to 50 tons in developed countries (giving a maximum payload of around 25 to 35 tons).

Table 1: **Axle Loads and Payload Capacities: Road Transport**

Road Vehicle	Axle load (tons)	Tandem axle load (tons)	Gross weight (tons)	Payload capacity (tons)
Road truck with two axles	8	13	13	7.5
	10	16	16	10.5
	13	19	19	13.0
Road truck with three axles	8	13	18	10.0
	10	16	22	13.5
	13	19	25	16.0
Truck trailer unit,	8	13	16a/	13.0a/
trailer with two axles	10	16	20a/	17.0a/
	13	19	26a/	22.5a/
Truck trailer unit,	8	13	21a/	17.5a/
trailer with three axles	10	16	26a/	22.5a/
	13	19	32a/	28.0a/
Semi-trailer unit with	8	13	21	11.0
three axles	10	16	26	16.0
	13	19	32	21.5
Semi-trailer unit with	8	13	31	17.5
five axles	10	16	38	24.0
	13	19	44	30.0

a/ Trailer only

(c) *Inland Waterways*

Inland waterways in developing countries are rarely used for the movement and distribution of containers since road and rail are, in general, more suited to container distribution requirements. Commodities which are most appropriate for inland waterways transport are those which are heavy and bulky and of low value. Only where waterways are deep enough and sufficiently close to large industrial and population centres (where demand for container transport is high) can waterways provide a transport service competitive with the more flexible and faster modes: road and rail.

CHAPTER III - Design and Layout of a Dry Port

A. Design Parameters

The policy aspects of planning a dry port are outlined in Chapter V. Design and layout are specific to each individual location depending on several factors, including traffic volume, traffic pattern, special trade requirements and conditions. It is, therefore, not possible to present one universally acceptable design. However, the important features of design, which can be modified and adapted to special needs, are outlined below. The dry port design encompasses rail siding(s) container yard (CY), container freight station (CFS), gate complex, boundary wall (fencing), roads, pavements, office buildings and public amenities. The operational analysis process for design is shown in Annex VIII.

There is considerable existing literature in which a discussion of the design parameters for a container terminal is outlined, including infrastructure requirements and equipment options. (See, for example, UNCTAD TD/B/C.4/238/Supplement 4 of 1982, Part Five: Ports and Container Depots). It is possible to generalize somewhat concerning the design of a dry port. A conceptualized design for a dry port layout is shown in Annex IX.

Before commencing on the design of a dry port facility, the planner must determine:

(a) The initial volumes of business to be handled;

(b) An estimated volume of cargo to be handled by the facility within a 10-year time horizon;

(c) The type of facilities and equipment that customers will require.

One constraint often encountered when the designer commences work is that which is set by the limits on the initial capital expenditure; the designer must usually try to limit early investment by starting with small volumes, while allowing room for expansion of the facility as business grows. Future facility extensions should be capable of being completed with minimum disruption to existing operations; the layout designer can assist in this process.

The layout designer should also try to incorporate flexibility into the plans. Estimates of volume of various activities cannot be totally accurate and so will be adjusted over time. Good initial layout should be capable of adaptation to changing circumstances.

The key to a good layout is the smooth flow of containers, cargo and vehicles through the dry port. Typical flows are shown diagrammatically for exports and imports in Annexes X and XI, respectively.

Each activity within the dry port will be analyzed individually below; the main factors determining the design of each area are considered in detail. The layout planner must however take into account the inter-relationships between the activities if the design is to be effective; for example if most of the full containers are likely to move directly between the rail-head and the container freight station (CFS), then those facilities should be as close together as possible. A small amount of space may he required for short term storage of a few empty containers. It is not good policy to encourage storage of empties at dry ports with relatively limited open storage areas.

The design process is an interactive loop, as many decisions will affect others, e.g. the type of lifting equipment selected will determine the container-stacking patterns, the pavement thickness, and engineering facilities; the number of personnel to be employed will affect the amenities necessary.

B. **Design Detail - the Rail Siding**

Container transport requires regular, reliable door-to-door transit, timely and low in cost. As it involves intermodal networking, the modal split should reflect the specific advantages of each mode. Accordingly, the role of rail transport will be mainly confined to specific routes of block trains/unit trains. Short hauls will be by road, connecting the users with the nearest dry port. In order to carry containers matching ISO standards, railways must meet certain minimum physical standards. The main design factors are track gauge, axle load, service frequency, number of trains, loading and structure gauge and the length and mass of unit trains.

(1) *Track gauge:* Varying track gauges are found around the world, as is evident in Table 2.

(2) *Axle load:* Restrictions are imposed by track quality, rail profile, and capacity of bridges. A permitted axle load of 12 tons in combination with the use of four-axle wagons is a minimum requirement for container transport.

(3) *Rolling stock:* Containers can be transported on existing multi-purpose flat cars or low-sided wagons or purpose-built container wagons. The choice should be influenced by the need to reduce tare weight while increasing pay-load per wagon and train. The tare weight and carrying capacity of some special container wagons in use in Europe are as shown in Table 3.

Table 2 - **Track Gauges of the World Railway Network**

Gauge (mm)	Nomenclature	Percentage of world railway network
1676	Broad gauge	
1670	Broad gauge	116
1600	Broad gauge	
1524	Broad gauge	119
1435	Standard gauge	162
1067		118
1000	Metre gauge	119
1762	Narrow gauge	
1610	Light gauge	116
		100

Source: Rail International, May 1978.

Only gauges of above 1000 mm are suitable for ISO container transport, subject to other clearances of dimensions.

Table 3 - **Container Wagon Weights and Capacities**

	(1) **Length (m)**	(2) **Height (m)**	(3) **Tare weight (tons)**	(4) **Pay load (tons)**	**Ratio (4/3)**
Type 1 (40ft)	15.79	1.18	18	62	3.4
Type 2 (60ft)	19.64	1.17	18	62	3.4
Type 5 (40ft)	13.86	1.18	12	28	2.3
Flat (2-axle)	13.86	1.235	12.5	27.5	2.3
Flat (4-axle)	19.90	1.305	24	56	2.3

(4) *Unit trains:* Based on the design of rail wagons and hauling capacity of the locomotives on the route, the total capacity of a unit train in terms of containers can be determined. Dividing the total expected throughput per annum by the carrying capacity of a unit train will give the total number of trains per annum. Divided by 52, this will give the weekly frequency of service. The length, number of sidings and capacity of cranes will have to match the volume and rate of arrival/despatch. The frequency of trains and size of sidings can be worked out on the basis of the following example, given that:

(i)Total containerizable trade volume = 120,000 metric tons per annum
(ii) Incoming traffic (imports) = 80 per cent of total volume

(iii) Outgoing traffic (exports) = 20 per cent of total volume
(iv) Carrying capacity of trains = 40 TEUs per train

Conversion into containers can be done as follows:

$$120{,}000 \text{ tons} = \frac{120{,}000}{15} = 8000 \text{ TEUs (15 tons/TEU)}$$

$$\text{Volume of imports (80 per cent)} = \frac{8000}{100} \times 80 = 6{,}400 \text{ TEUs}$$

$$\text{Volume of exports (20 per cent)} = \frac{8000}{100} \times 20 = 1{,}600 \text{ TEUs}$$

Generation of empties (TEUs) = 6,400 - 1,600 = 4,800 TEUs

Total throughput at the dry port (TEUs) = 6,400 + 1,600 + 4,800 = 12,800 TEUs/annum

$$\text{Total number of incoming trains} = \frac{6{,}400}{40} = 160 \text{ per annum}$$

Number of incoming trains per week = 3.

The total number of outgoing trains will normally be approximately the same. Thus for a volume of trade equal to 120,000 tons per annum and a non-seasonal pattern of traffic with more imports (80 per cent) than exports (20 per cent) the average train arrivals per week will be the same as the number of departures. The number of sidings will depend upon the average occupancy of tracks and upon the speed with which trains can be unloaded and back-loaded. This figure will, in turn, depend upon the lifting equipment installed at the siding. As a matter of precaution, and considering the importance of the turnround time of wagons, one siding per train (inward/outward) should be provided. In this hypothetical case, for three inward and three outward trains per week, full train length sidings should be provided and one spare track should be available for engine escape and other contingencies.

There should be no disruption of the train schedule. Road vehicles **must** be prompt and, as such, the container yard may be used as a "buffer" zone so that, if any adjustment is needed, road vehicles may be scheduled around the train timetable.

When designing the rail siding, the following factors should be considered:

- Direct reception of trains into the siding will reduce the holding time of wagons in yards;

- Tracks in the rail siding should be joined at both ends to facilitate two-way entry and departure of rolling stock;
- There should be arrangements for securing the wagons to prevent any rolling or movement during loading/unloading operations;
- The siding gradient should be level; and
- Minimum dimensional clearances between parallel tracks should be available.

Conceptual diagrams for rail sidings are given in Annexes XII to XIV. Note that terminal size is here defined as:

Large - More than 100 containers per day
Average - 20 to 100 containers per day
Small - Up to 20 containers per day

C. **Design Detail - the Container Yard (CY)**

General criteria

Normally, each dry port with a throughput of more than two trains a day should have a separate container yard (CY) where containers can be stacked. This is advisable for the following reasons:

(a) Productivity of the gantry cranes is better and, therefore, detention of wagons is reduced. Otherwise if the rail crane has to transfer directly the containers from rail to private vehicles and vice versa, delays may occur. Where the throughput is small, transfer can be done by the gantry crane itself, although this has disadvantages which will be discussed later in the context of equipment.

(b) Precise streams of traffic can be established: one between rail siding and CY and the other between CY and the CFS and gate. This streaming is important so as to avoid accidents.

(c) A buffer area is thus created for traffic fluctuations. The input/output ratio can never be precisely matched in day-to-day operations.

A CY is a paved level area where containers can be stacked in tiers. In practice the tiers are usually a maximum of three high so that easy random access is assured and also because of machine handling limitations.

It is normally not practical for containers to be directly delivered from rail to road vehicles or vice versa. However, containers do not go out of the dry port in the order of their arrival;

for export, the departure of a shipment has to match the sailing of a vessel from the sea port, and, for imports, time is needed for completion of formalities by importers. Therefore, storage of containers is invariably required. This is done in the CY.

Size

The size of the CY will depend upon the optimum number of containers to be stored at any given time which is a function of the dwell times (DT) of containers, which differ for imports, exports and empty containers. Normally seven days for imports, three days for exports and 15 days for empties is considered reasonable. The storage requirement can be worked out taking the example of 12,800 TEU non-seasonal throughput described above. Hence:

Exports = 1 600 TEU/annum or 5 TEUs/day
at 3 days DT for each average inventory will be: 5 x 3 = 15 TEUs

Empties = 4,800 TEUs/annum or 14 TEUs/day
at 15 days DT average inventory will be: 14 x 15 or 210 TEUs

Total daily average inventory without peaking = 126 + 15 + 210 = 351. The total storage capacity of the CY should in this case be 351 plus a peaking allowance. The number of ground slots will be a fraction of the stack height. While equipment is available to stack containers five high, this height is not practical, as containers have to be shuffled for access. If the stack is full, shuffling and access become very difficult. The number of ground slots will also vary with the type of equipment used. Likewise, their arrangement will be different, depending on the handling equipment used. For a gantry crane, the slots can be in one block; for top lift trucks or fork lift trucks, the depth of each stack should not be more than two TEU for random accessibility. In large dry ports, different equipment with different stacking patterns may be used for full and empty containers.

Paving

The surface alongside the railway tracks and siding inside the CY should be paved in accordance with the dynamic axle loads of the equipment and vehicle plying across the area. Heavy-duty pavement would be required where fork lift trucks (FLTs) operate or where the tracks of a gantry crane are laid. Other roads and pavements may be similar to ordinary normal roads. Specifications should be obtained from the equipment manufactures as far as gantry crane foundations are concerned. (See also UNCTAD Monographs on Port Management - No. 5, Container Terminal Pavement Management). The area where only containers are to be stacked need not be very heavy duty pavement except to the extent that corner castings of containers must not sink.

D. **Container Freight Station (CFS) and Transit Shed**

General criteria

A CFS is basically meant for less than container-load (LCL) consolidation/segregation. It is where containers holding more than one consignment are packed or unpacked. The CFS comprises a covered shed with a loading apron for trucks accessing containers stacked inside a shed.

Storage procedures significantly affect the efficiency of a shed. Inefficient storage can lead to a total breakdown in the operation of the shed. Long average storage time and lack of a proper trucking system tend to give rise to serious problems such as excessive cargo damage, slow cargo handling and congestion beyond the shed.

The shed should be divided into two sections: one for export cargo and another for import cargo. The total storage area in the shed should be divided into smaller areas or lots, suitably marked with identifying numbers or letters in order to facilitate fast location of cargo. When dividing the total storage area into smaller areas, alleyways of sufficient width for safe passage and efficient operation of cargo handling equipment should be allowed. For fork-lift trucks, the width of such alleyways should be at least 4 metres. In the main alleyways, fork-lift trucks be able to meet and must pass each other without slowing down the operation.

The shed may also contain shelf space for single packages and small quantities, strong-room space for valuable cargo, a special area for stowing dangerous cargo or cargo with strong odours and space for the offices of staff and checkers. In addition, the shed should have adequate ventilation and efficient firefighting equipment.

Customs staff must be present in the shed to break container seals and examine containers and cargo as they are packed and unpacked. Separate examination areas may be required; these should be located conveniently in consultation with local Customs officials.

Three examples of shed design are given in Annex XV. To these may be added a further type (not illustrated) which has a sloping floor such that direct access is at one side and loading bay truck operation take place at the opposite side. The slope must not be so steep as to hinder cargo stacking or fork-lift truck operations.

Shed Size

The size of the CFS, excluding Customs examination areas and other specially designated areas, depends on the anticipated throughput of LCL TEUs and the average cargo storage or dwell time.

There must also be provision for the following fixed items:

(a) The area of floor space occupied by an average container-load of cargo taking into account the height to which it may be safely stacked outside the container.

(b) The amount of space required for a fork-lift truck to manoeuvre.

(c) A factor for covering peak workloads at certain times (excluding large seasonal peaks, which should be considered separately).

The following variable items must be accounted for:

(d) The average dwell time of cargo (likely to be different for exports and imports).

(e) The number of working days per year.

Shed space is then calculated as equal to

$$\frac{\text{TEUs per annum} \times (a) \times (b) \times (c) \times (d)}{(e)} \text{ square metres}$$

Experience in existing dry ports has shown that for a flat floor shed the fixed factors (a), (b) and (c) can be combined as equal to "40". Therefore, as an example, for a 5,000 TEU per annum throughput with an average of 5 days cargo dwell time and operational 300 days per year.

$$\text{Shed space} = \frac{5{,}000 \times 40 \times 5}{300} = 3{,}300 \text{ square metres}$$

The sensitivity of shed size to cargo dwell time should be emphasized. If the dwell time doubles, then the shed space required doubles for no extra cargo throughput. Equally important is the space requirement of individual cargoes; this is known as the cargo stowage factor. A guide to stowage factors is provided in Annex XVI.

Number of doors

The number of doors needed in the shed through which containers can be accessed may be estimated on the basis of the expected number of containers to be handled daily. It can be assumed that each container will take approximately two hours to handle,

e.g. 5,000 TEU per annum = 17 TEU per working day
an 8-hour working day = 4 containers at any one time

While one container is being moved, for greatest efficiency, another should be brought into position ready for handling; therefore, at least eight doors will be required. Once again care must be taken to adjust the final figure for peaks and for seasonality of cargo movement.

E. **The Gatehouse and Security Features**

The gatehouse is the main focal point of site security. For a large dry port, it is recommended that the gatehouse be built on two levels with access to the roof for security personnel. All vehicles must report to security staff upon entry and exit from the depot. Security staff should sit at side windows of the gatehouse at a height sufficient to be able to see inside the cabs of all vehicles and to receive documents from drivers without the need for them to alight from their cabs. Security staff on the ground floor can check container seals and loads while, if necessary, roof access can allow checking of containers for damage on top of loads which would otherwise be out of sight.

The security guard at the reporting window should control moving barriers outside the gatehouse, allowing traffic to proceed in and out of the depot when the documentation has been verified. All vehicles entering or leaving the site must have a relevant permit authorized by a designated authority in the administration. Security staff must be empowered to search and examine all people and vehicles leaving the site, even if this power is exercised only in random fashion. Such control will minimise the possibility of revenue loss to Customs and importers.

Full personnel facilities should be provided in the gatehouse, as, beyond normal working hours, this building may be the only one on the site that is being occupied.

The security force should also be responsible for opening and policing the site gates to the railway lines so as to ensure that there is no unauthorized entry. Perimeter patrolling should be carried out, especially at night, to ensure that no unauthorized access occurs.

Perimeter fencing and lighting must meet the standards required by Customs authorities. Security staff should be positioned in the CFS during operational hours so as to carry out random checks on cargo loading, and to prevent pilferage. Such staff should also be responsible for securing the CFS when it is not in use and for patrolling the site perimeter.

F. The Administration Building and Communications

The administration building is the focal point of production and processing of all documentation relating to the handling of cargo at the dry port. Its function is to ease the communications which must take place between the many parties involved in the dry port operation and therefore increase its efficiency. The building can also provide useful income to the dry port whose management can act in the capacity of landlords, letting out office space to those who require it. Typically the building will contain offices of the site management, Customs, freight forwarding agents, multimodal transport operators' agents, road transport operators, banks, telephone/fax/telex office and related services.

The size of the building will be determined by the needs of potential occupants. The building will have to be very flexible in order to accommodate many different tenants with varying space requirements. It is recommended therefore that the main core of the building be open space capable of division into different sized offices by partition walls. Fixed provision can be made for sanitation facilities and possibly a food service facility. The building should be capable of expansion both vertically and horizontally, since inevitably the greater the use of the dry port, the more companies will find it convenient to have staff on the site.

It may be helpful to erect the building outside the main security area of the dry port although there should be a restricted-access "back" door for those personnel who must enter the operational area (mainly Customs and dry port management staff). Most of the people housed in the building would have no justification to enter the security area and should not be allowed to do so.

Also of potential value is the provision of appropriate accommodation and shopping facilities in the vicinity of the dry port as well as fuel supplies, parking facilities and vehicle maintenance and repair sheds. This would indirectly encourage use of the dry port.

In any dry port many parts of the operation are inter-dependent; it is thus most important to provide for excellent internal communication. It is recommended, therefore, that all the various buildings, sheds, workshops, stack offices and railhead offices be linked by an internal telephone system. In addition, external telephones should be provided in the administration building, workshop, CFS and gatehouse. The provision of communication services to the administration building should take into account the large number of external telephone and telex lines that will undoubtedly be required by the various tenants.

Input to the railways communication system is also important so that train loading details can easily be transmitted and received.

G. **Vehicle Holding Area and Traffic Flows**

It is usually helpful to have a paved container - and vehicle-holding area outside the main security area, with external access to the administration building. Such an area allows drivers to park and obtain instructions, and arrange paperwork, through offices in the building, thus ensuring that all cargo is accompanied by correct documentation and that anyone concerned can carry out their tasks within the dry port before proceeding into the security zone. This practice prevents vehicle bottlenecks at various operational areas around the site and, upon exit, keeps the flow moving past the gatehouse, where authorization to remove containers or goods will be finally checked.

Wherever possible, one-way traffic flows should be arranged and enforced both inside and outside the security area. This not only improves safety but eases congestion. In this context, routes should be clearly marked by signs and by white line markings on the road surface.

H. **Equipping a Dry Port**

Different handling systems are reflected in the various designs of the terminals using them. It cannot be generally concluded that any one of these systems is superior to another; each one has to be judged on its own merit and in terms of local circumstances. Furthermore, the systems are not necessarily applied in their pure forms; very often mixed systems are used for sound financial reasons. With mixed systems, the most suitable equipment can be used for a particular operation.

Tailor storage system (chassis system):

In this system, the container always remains on the chassis while in the dry port until it is picked up for further transportation. The advantages of the system are:

- High flexibility;
- Rapid terminal transport;
- Random accessibility of containers;
- Low ground pressure and consequently low requirements for soil conditions supporting loads.

However, the system places severe constraints on space and equipment. The disadvantages are large space requirements and, most importantly, the considerable expense entailed by the large number of trailers required.

Heavy fork-lift trucks:

Heavy fork-lift trucks, with carrying capacities of up to 45 tons can be used for handling both empty and laden containers. The tiers are normally three high. Special attachments are used for handling containers. The basic options are sidelift or toplift spreaders, the latter being predominantly used. Fixed frames can be used, but they must be changed when different sizes of containers are handled.

There are both advantages and disadvantages in using fork-lift trucks for container handling. The advantages are that the equipment is flexible. Moreover maintenance, which is an important factor in developing countries, is comparatively easy and personnel already familiar with fork-lift trucks can normally undertake servicing without extra training. The disadvantages are that the equipment is slow and, therefore, it can be used only for low throughput rates; there are large space requirements for stacking and travelling; and the heavy front axle loads require heavy-duty area surfacing and solid foundations. Normally the use of heavy fork-lift trucks considerably increases the requirements for maintenance of paved areas.

Fork-lift trucks with lifting capacity of 3 tons for CFS:

Fork-lift trucks were originally designed for the carriage of general cargo which could be handled with lifting forks, e.g. palletized cargo, crates, and large bales of cargo on stevedoring pallets. Such trucks are mainly used for the loading and unloading of conventional general cargo to and from trucks, stacking of cargo in the CFS as well as packing and unpacking of containers. Fork-lift trucks with a minimum lifting capacity of up to three tons may be used, depending on the bearing capacity of the floor. Special attachments are used for stuffing and unstuffing of drums and rolls of paper. Examples of fork-lift attachments are shown in Annex XVII.

Straddle carriers:

These machines straddle a container, lift it up, then move along with it. Straddle carriers can be used for transfer operations between loading and unloading points and storage as well as for stacking. The advantage is that for smaller units the straddle carrier can perform all container handling operations (hoisting and horizontal transport) in a fast and flexible way. Straddle carriers can stack containers up to four high, although tiers three high are more common. A small straddle carrier, designed for lifting one container over another, is illustrated in Annex XVIII.

In the past, straddle carriers often had poor performance records, mostly resulting from breakdown in the hydraulic mechanism or in the traction system. These difficulties, however,

have been largely overcome with improved hydraulic systems and better designed mechanical systems.

Transtainers:

Rubber-tyred or rail-mounted transtainers (gantry cranes) allow the greatest performance in terms of storage capacities with the highest loading and unloading efficiency in the rail yards (see Annex XIX). This equipment can be delivered with different specifications: the span between the legs can vary - for rail mounted transtainers up to 50 metres, and for rubber-tyred ones up to 25 metres. The disadvantage is that the equipment is not appropriate for smaller operations owing to its fixed location (rail-mounted) or inflexibility in moving from one place to another (rubber-tyred). The transtainer is suitable for use primarily for horizontal transport in conjunction with the tractor-trailer (chassis) system.

Side loaders:

The side loader is especially designed for transfer of containers over longer distances. It can stack containers three high. The disadvantage is its large space requirements. In picking up and stacking containers, hydraulic supporting legs fan out to prevent toppling of the equipment but this feature reduces the speed of handling considerably.

Mobile cranes:

For transfer of containers, e.g. to and from floating barges, heavy mobile cranes can be used with a lifting capacity of up to 50 tons to reach laden containers across a span of 10 to 12 metres. Wider barges have to be turned around for access to the other side.

Reach stackers:

This relatively new type of equipment combines the features of a heavy fork-lift truck with those of a mobile crane. Containers are lifted from the top by a rotating spreader fixed to the mast of a mobile chassis. The equipment is very flexible and in small throughput situations could be used for handling loads both at the railhead and in stacking operations. It does, however, require more space than other equipment.

Tractors (tugmasters), trailers and chassis:

Tractors and trailers are used for horizontal transport over longer distances and are used in combination with hoists. There are two types of trailers or chassis: the road and the terminal type (see Annex XX). The road type is mainly designed for highways. They are fitted with

lights, brakes and spring suspension, features not usually found in terminal chassis or trailers. Both types can be used for container handling in the dry port, but the terminal chassis is normally of a heavier construction suited for intensive use. With regard to the actual hoisting of containers, a variety of attachments and hooking systems may be used in conjunction with conventional hoists or gantry cranes (see Annex XXI). Conventions with regard to container numbering codes have aided in container identification (see Annex XXII).

Special equipment for CFS:

Tractors and trailers are used for horizontal transport over longer distances and are used in combination with hoists. There are two types of trailers or chassis: the road and the terminal type (see Annex XX). The road type is mainly designed for highways. They are fitted with lights, brakes and spring suspension, features not usually found in terminal chassis or trailers. Both types can be used for container handling in the dry port, but the terminal chassis is normally of a heavier construction suited for intensive use. With regard to the actual hoisting of containers, a variety of attachments and hooking systems may be used in conjunction with conventional hoists or gantry cranes (see Annex XXI). Conventions with regard to container numbering codes have aided in container identification (see Annex XXII).

Special equipment for CFS:

For cargo handling in the CFS shed, a number of loading/discharge appliances may be used, for example, stevedoring pallets, hand trucks, hydraulic handlift trucks, pallet trucks and fork-lift trucks with special attachments for drums and rolls of paper.

It will be appreciated that the choice of equipment for the dry port (as discussed in Section B) will have a major impact on the overall design of the port, and several different combinations of layout and equipment must be considered if the most cost-effective dry port is to be established. Dry port equipment, scale, site access, site shape and estimated throughput must therefore be considered simultaneously at the planning stage.

CHAPTER IV: Operating and Managing a Dry Port

Introduction

Previous chapters described the many different organizations that must function interdependently if a dry port is to be successfully operated. All of them can benefit if the dry port is effective, but none will gain unless they all exercise goodwill and recognise their interdependence. That is to say, there is little point in running efficient container trains if customs make clearance procedures impossibly bureaucratic, or if transport operators do not issue appropriate multimodal transport documents. The relationships between parties may be complicated by the fact that some of them may be state-owned, or government agencies, and some may be private-sector organizations.

It is important to note that dry port developments normally form part of a national plan (usually within the transport section). As such, dry port development programmes have to fit with other national schemes and budgets. They often form part of a railway upgrading project, but may also be linked to highway construction, sea port expansion and similar transport links.

The potential difficulties that could arise between the organisations involved should be recognized before a dry port is established; some formal means of overcoming obstacles should be built into the development plan. This may be done by involving several parties in the funding of the dry port and providing them with Board level representation (see section A below), or it may be achieved by the establishment of an official trade supervisory body, associated with the dry port, whose function would be to ensure that all parties have reasonable lines of communication with the Board members of the dry port.

A. Initial Capital Provision

A dry port may be funded wholly by the public sector or wholly by the private sector or by a combination thereof. The advantages and disadvantages of various combinations are analysed below.

Total public sector funding

With this option, development funds would be provided by the general exchequer or through a public sector organization such as the railway. The government would retain direct control over operations, revenues and transport modes. Though efficiency of the dry port may be restricted under such a regime, it could offer greater equality in treatment to all users, and more equitable distribution of cargo among various modes within a centrally planned

transport policy. The shipping lines and foreign agencies involved in dry port operations may feel reassured concerning the operation. Theoretically, it minimizes chances of malpractice such as: profiteering, unreasonable tariffs, discrimination among user agencies, etc. Nevertheless, there may be disadvantages; these might be related to the experience and impressions of government functioning **vis-a-vis** private-sector business practices. Furthermore, it may be difficult to allocate sufficient funds through the general exchequer, depending on prevailing national priorities.

Total private sector funding

The development of container handling facilities in the least developed countries (LDCs) of Southern Africa indicates a predominance of private sector investments at present. Under this option, the greatest advantage is the mobilization of private resources in the national transport infrastructure. All the direct benefits flowing to the national economy through such private investments makes it an attractive proposition. Private management, implied by private investments, can sometimes be more flexible and responsive to trade, particularly as concerns changes in tariff structure, quick response to altered patterns of operations and the catering for special needs on a day-to-day basis.

Combinations of private - and public-sector funding

This option provides for two possible types of combination:

(a) The public sector provides some facilities, e.g. railhead and main container hoists, and the private sector provides other facilities. e.g. CFS facilities.

(b) The public and private sectors provide the funds for a joint site operation under one management with unified control.

Option (a) presents some advantages, as the provision of a railhead and associated hoisting equipment is likely to be fairly capital-intensive and to represent a longer term investment than that of other site facilities. There is a danger though that the other facilities will be provided on an **ad hoc** basis, with no real development plan and their management objectives will be different from those of the railhead. Inevitably there may also be some duplication of management function within the complex as a whole. This type of development can attract "maverick" operators acting within the cargo handling areas. It should be considered that the activities of a dry port, especially in a developing region, are too inter-related for true independence.

Option (b) ensures that the dry port complex functions and develops in a coherent manner, albeit without some of the flexibility associated with totally private sector operations.

Control

Whatever the funding structure agreed upon for a new dry port, a government can exercise control over site activities through its customs services, as all operations will be performed under their scrutiny.

B. **Management Principles in a Dry Port**

The capital structure of the dry port will obviously influence the composition of the controlling body, whether it is a Board of Directors or some other organizational entity. In the early stages of planning, the controlling body will have to create a framework harnessing many different skills for the successful establishment of the dry port; layout planners and engineers to design the physical attributes of the facility; customs and shipping experts to establish clearance procedures; railway experts for track layouts; accountants for managing development resources, etc. However, once the facility has been established some of these skills will only be occasionally required. The controlling body must therefore:

(a) Create a management structure suited to the size of the facility and one which does not overburden it with unnecessary costs;

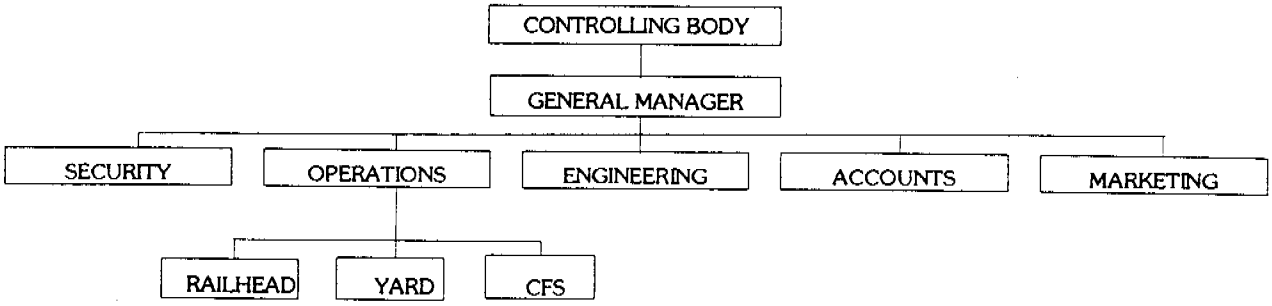
(b) Set clear objectives for management;

(c) Monitor management success.

It should be noted that (depending on the ownership structure), although success need not be measured solely in terms of profit or loss from the dry port operation itself, it has been shown that better results are obtained from a management team if its responsibilities are limited to a local environment, i.e. the controlling body may be responsible for more than one dry port, but management should be in charge of one site only and resident at that site.

C. Management Structure

A typical organizational structure for a dry port might be as follows:



The size of the dry port will determine whether each of the functions is of sufficient importance to warrant having its own manager or if managers could have responsibility for more than one function.

D. The Management Team

The General Manager

This post is obviously of the greatest importance if the dry port is to be a success. The post should be filled at a very early stage of site development so that the person finally responsible for controlling the site has the opportunity to provide a major input to its design and procedures.

The appointee will undoubtedly need skills and experience in handling labour, but the most suitable manager will probably have commercial experience in port operations. Although the railway is important to a dry port as a means of transporting containers to and from the site, the railway commercial environment is generally quite different so that personnel from a railway background is unlikely to have the experience required for managing a dry port.

The General Manager appointed will almost certainly need initial training in an existing dry port environment as well as external support from experienced dry port managers at critical stages of the port's development. So as to ensure the success of the dry port, the General Manager will have to establish vital commercial links with international multimodal transport operators, shipping companies, local freight forwarders, the railways, the appropriate port authority (although they may be in another country,) and local exporters and importers. The General Manager will have overall responsibility for recruiting site staff and especially for selection of the senior functional managers.

Head of operations

This post will probably be the next most senior after that of General Manager. The person holding it will be responsible for the day-to-day operations of the site. Like the General Manager's function, there would be great advantages in making an early appointment of the Head of Operations. Work experience in a functioning dry port should be provided.

Experience with container and cargo handling is essential, together with the necessary personnel management skills for dealing with a manual labour force. Depending on the dry port size, the Head of Operations will probably need to appoint staff to supervise the different parts of the complex, e.g. railhead, transit shed and container yard.

It will be necessary to establish a system of regular communication with interested parties regarding cargo status, container status (packed, unpacked, customs cleared, etc) and transportation information. Such a function can fall under operational management or, because it is largely administrative, be supervised by the Accounts Manager. It would be useful if such a system of communication were EDP-based.

Head of Accounts

This post does not necessarily require an incumbent with knowledge of dry port operations; obviously accountancy training and experience with information systems are essential. The accounts department will probably be responsible not only for paying wages, preparing invoices and producing accounts statements, but will also be required to provide management information to all other managers regarding operational statistics and costs. Such information will assist the General Manager in determining correct tariffs for different operations and customers.

At an early stage of development, a decision must be taken on how to charge the customer (see section G), that is, should all customers pay the same charge per container regardless of volume of throughput? Should charges be per container, inclusive of all lifting, storing, packing and unpacking or should each operational function be charged separately? These are some of the questions which may be asked. The decisions will indicate the complexity of the invoicing process and the size and profile of accounts staff required (see also section G). The accounts department should be computerized from the start using suitable software packages designed for an existing dry port.

Head of Engineering

The engineering function is not specific to a dry port operation. The main requirement, on a day-to-day basis, will be to oversee maintenance of the container lifting equipment, fork-lift trucks and transport vehicles; therefore the emphasis will be on mechanical skills.

The Head of Engineering, however, could be involved in site development work if the engineer in question has an understanding of civil and railway engineering.

Security Officer

Although shown as a functional responsibility within a dry port management structure, this task may be performed by customs personnel or by some form of local police or by private security guards. The department is ultimately responsible for ensuring that no cargo moving through the premises is undesirable or has avoided the appropriate duty levied upon it.

Security staff will be responsible for checking all outgoing and incoming shipments and for patrolling cargo storage areas. The way the Security Department approaches its task is extremely important to the smooth running of the dry port. If security staff were to search every container and vehicle leaving or entering the dry port in minute detail, then operations in the complex would be brought to a standstill. It is recommended that the Security Department try to maintain continuous surveillance of the premises, do random searches of vehicle and personnel and target suspicious cargoes or organizations for close scrutiny.

A senior security officer who can maintain the business activity of the dry port while ensuring that Government revenues are safeguarded will be of considerably more use than one with a rigid "military type" approach to security matters.

E. **Marketing Philosophy**

In a developing country, a dry port project often forms part of transport developments which are centrally planned. The main objective of a dry port is to facilitate the flow of international goods economically and speedily to suit the requirements of the customer. A dry port becomes ineffective if the targeted cargo throughputs do not materialize or if the transport infrastructure is unsatisfactory. Since door-to-door transport requires the integration of sea, road and rail transport, a weakness in any link affects the entire chain of activities. It is important, therefore, that all functions in the chain be properly co-ordinated to bring about the desired results. This aim applies equally to the gateway maritime port where inefficiency can adversely affect the functions of the dry port.

Marketing of the dry port services, therefore, involves close association and co-ordination with each one of the agencies making up the total chain. The ability to understand clearly the market forces which dictate the future requirements of dry port users in terms of both facilities and services is an important aspect of long-term planning.

The concept of marketing the services of a dry port is more complex than it might first appear, especially as the organizations paying the dry port for services rendered are not necessarily the customers, or even the decision-makers considering whether or not to use the dry port. The role of marketing is not limited to the local area of the dry port because even if local exporters and importers were willing to use the services offered, cargo could not flow without multi-modal transport operators being persuaded that containers should be moved to it, and appropriate multi-modal transport documents issued. The senior marketing person must, therefore, have a broad understanding of all the organizations that influence cargo flows through the dry port. These flows have been illustrated in previous sections.

Undoubtedly some marketing tasks will have to be undertaken by the General Manager because of the importance of the decisions to all organizations involved; it may be advisable to appoint a person who can assist the General Manager with the administration of the marketing activity, rather than have this task performed at a subordinate level.

F. **Customer Determination**

One of the most complex questions to be answered when marketing a dry port is: "Who is the customer?" The services of the dry port will be paid for by all or some of the following entities:

(a) The multimodal transport operator or an agent who pays for container lifting, storage, packing, and unpacking;

(b) The freight forwarder who pays for cargo-related charges;

(c) The railway authority which is responsible for train-related charges;

(d) Various tenants in the dry port offices who bear occupancy related charges.

However, ultimately the cost of all charges is borne by the cargo exporter or importer, with whom the dry port will have little direct contact. Obviously the dry port must attract the favourable attention of all parties involved in the transport chain in order to succeed.

G. Tariff Chain and Marketing Levels

The other marketing difficulty encountered by a dry port is that its charges are only one in a series of costs to the ultimate customers and that no matter how competitively the dry port sets its tariffs, if for example the related railway charges are too high, or the sea port transfer charges are excessive, then the dry port business operates at a disadvantage without significant improvement over sea port clearance.

The problems must be tackled at many different levels by the dry port marketing section. Marketing involves not only promotion of the image of one's own organization, but also that of several others in this case.

It should be recognized that, like the dry port operator, who does not have direct customer contact, so too, the multimodal transport operator (MTO) probably expects a dry port to act as a common user facility, it will also expect the dry port to present a neutral but efficient image to its own customers.

It is more than likely that a MTO will be asked to stream all its local business through the dry port. In some land-locked states, the operator may have a choice only between border clearance of containers or clearance at a single dry port. The efficiency and image of the dry port is, therefore, of great importance to the MTO. Probably this consideration calls for direct contact by the General Manager rather than dealings at a subordinate level.

It is vital, then, that a dry port be perceived by its customers as an operation which is modern and thoroughly professional both in outlook and mode of operation. Even in the most centrally planned and carefully controlled economies, it is unlikely that a dry port will be free of commercial competition from alternative cargo routes. Therefore, it must be in a position to compete economically against those alternatives. Its ability to compete for cargo in the long term will largely determine a dry port's level of success and ultimately its survival.

ANNEXES

Annex I - **Breakdown of annual TEU growth in world container movements by region 1981-88** *(figures expressed in proportional percentage change)*

Region	1981	1982	1983	1984	1985	1986	1987	1988
Far East/Asia	3.4	1.6	3.8	4.9	2.8	5.6	5.3	5.1
Europe	2.3	0.6	1.8	4.0	1.3	1.3	2.1	2.7
North America	- 0.3	0.8	2.0	3.8	1.9	1.6	1.0	1.5
Caribbean/Central and South America	0.4	0.4	0.4	3.0	0.2	0.4	0.8	0.4
Africa	0.8	- 0.1	- 0.1	0.5	0.0	0.0	0.2	0.3
Australasia/South Pacific	0.2	0.2	- 0.1	0.4	0.1	- 0.1	0.2	0.3
Mid-East	1.4	0.7	0.7	0.4	- 0.3	- 0.2	0.2	0.3
Total growth (%)	**8.2**	**4.2**	**8.5**	**17.0**	**6.0**	**8.6**	**9.8**	**10.6**

Annex II - **Top 20 container-handling countries in 1988 based on total TEU throughput**

1988 rank	Country	Total TEU 1988	Total TEU 1987	1987 rank	Gain (%) 1987/88
1	US	13 543 198	13 258 276	1	6.9
2	Japan	6 878 722	6 210 011	2	10.8
3	Taiwan	4 941 023	4 772 339	3	3.5
4	Hong Kong	4 033 427	3 457 182	4	16.7
5	UK	3 681 739	3 337 037	5	11.2
6	Netherlands	3 379 910	2 948 609	6	14.6
7	Singapore	3 375 100	2 634 500	7	28.1
8	West Germany	2 816 559	2 561 689	8	9.9
9	South Korea	2 205 532	1 949 143	9	13.2
10	Spain	1 725 059	1 685 994	10	2.2
11	Belgium	1 724 267	1 670 983	11	3.2
12	Italy	1 631 500	1 559 534	12	12.1
13	Australia	1 575 393	1 433 135	13	13.8
14	France	1 436 204	1 341 232	14	7.0
15	Canada	1 402 455	1 288 233	15	7.3
16	Puerto Rico	1 174 033	1 033 609	16	13.6
17	Philippines	1 098 473	913 909	17	14.5
18	UAE	1 042 637	957 558	18	8.9
19	Saudi Arabia	822 663	829 752	19	- 1.8
20	Brazil	815 188	666 007	20	22.4
	Sub-total	*59 303 082*	*54 508 732*		
	Others	*13 624 941*	*12 747 849*		
	World total	**72 928 023**	**67 256 581**		**10.6**

Notes: percentage growth rate 1987/88 based on ports providing data to Containerisation International Yearbook for both years.

Annex III - **Top 20 container ports in 1988 based on TEU throughput**

1988		Total TEU		Gain (%)	Estimatd	Gain (%)
rank	Port	1988	1987	1987/88	TEU 1989	1988/89
1	Hong Kong	4 033 427	3 457 182	17	_	_
2	Singapore	3 375 100	2 634 500	28	4 200 000	24
3	Rotterdam	3 288 829	2 838 605	16	3 450 800	5
4	Kaohsiung	3 082 838	2 778 786	11	3 216 842	4
5	Kobe	2 232 911	1 996 626	12	1 990 362	- 11
6	Busan	2 205 532	1 949 143	13	2 471 000	12
7	New York/New Jersey	2 095 530	2 089 421	0	2 150 000	3
8	Keelung	1 761 695	1 939 854	- 9	1 700 000	- 4
9	Los Angeles	1 652 070	1 579 657	5	1 735 000	5
10	Hamburg	1 621 615	1 451 351	12	1 730 000	7
11	Long Beach	1 539 803	1 460 287	5	1 600 000	4
12	Antwerp	1 469 949	1 437 193	2	_	_
13	Yokohama	1 452 857	1 348 383	8	1 550 000	7
14	Tokyo	1 396 026	1 287 974	8	1 400 000	0
15	Felixstowe	1 278 893	1 052 862	21	_	_
16	San Juan	1 135 724	1 004 380	13	1 199 483	6
17	Bremen/Bremerhaven	1 121 454	1 043 218	7	1 183 000	5
18	Seattle	1 024 035	1 026 398	0	1 010 000	- 1
19	Oakland	1 020 600	953 861	7	1 098 000	8
20	Charleston	800 236	644 533	24	_	_

Notes: *estimated from part-year result; **official estimate

Annex IV: **List of tasks to be performed by the MTO when organizing door-to-door transport operations.**

	FCL	LCL
1.	Contact/negotiations between exporter/ shipper and the MTO	Contact/negotiations between exporter/ shipper and the MTO
1.1	Presentation by the exporter/shipper of all relevant information covering the project	Presentation by the exporter/shipper of all relevant information covering the project
1.1.1	Cargo commodity/commodities: ordinary cargo - reefer cargo - dangerous cargo, heavy lift, etc	Cargo commodity/commodities: ordinary cargo - reefer cargo - dangerous cargo, heavy lift, etc
1.1.2	Weight and measurements	Weight and measurements.
1.1.3	Packing details, material, strength, type	Packing details, material, strength, type.
1.1.4	Marketing	Marketing
1.1.5	Place of shipment	
1.1.6	Port of loading	Port of loading
1.1.7	Port of discharge	Port of discharge
1.1.8	Final destination	Final destination
1.1.9	Delivery time according to sales contract	Delivery time according to sales contract
1.1.10	Delivery terms, INCOTERMS 1990 specifications	Delivery terms, INCOTERMS 1990 specifications
1.1.11	Payment terms - letter of credit contitions	Payment terms - letter of credit contitions
1.1.12	Insurance coverage and terms	Insurance coverage and terms
1.2	Transport quotation from MTO	Transport quotation from MTO
1.2.1	Presentation of company profile with reference to earlier completed transport contracts	Presentation of company profile with reference to earlier completed transport contracts
1.2.2	Feasibility study/local infrastructure/ climatic conditions, etc.	Feasibility study/local infrastructure/ climatic conditions, etc.
1.2.3	Presentation of transport combi-nations/alternatives/sea/road/rail/ air/inland water transport	Presentation of transport combi-nations/alternatives/sea/road/rail/ air/inland water transport
1.2.4	Specification of proposed carrier/ local/overseas	Specification of proposed carrier/ local/overseas
1.2.5	Expected total transit time	Expected total transit time

	FCL	LCL
1.2.6	Offer for total transport operation door-to-door clearly stipulating transport route/routes, transhipment points, charges covered by the transport offer, charges not covered by the transport offer. Supervision of the transport operating during the various phases	Offer for total transport operation door-to-door clearly stipulating transport route/routes, transhipment points, charges covered by the transport offer, charges not covered by the transport offer. Supervision of the transport operating during the various phases
1.2.7	Payment of freight and charges. Cash payment of credit arrangements	Payment of freight and charges. Cash payment of credit arrangements
1.2.8	Conditions of carriage - use of transport documents - regulations and international transport law and rules	Conditions of carriage - use of transport documents - regulations and international transport law and rules
1.2.9	Local conditions and regulations for carriage of goods in country of destination	Local conditions and regulations for carriage of goods in country of destination
1.2.10	Customs regulations in country of destination	Customs regulations in country of destination
1.3	Concluding and issuance of final transport contract	Concluding and issuance of final transport contract
1.3.1	Negotiation of multimodal transport document stipulating all necessary details in order that the transport can safely be carried through to the final destination without misunderstanding	Negotiation of multimodal transport document stipulating all necessary details in order that the transport can safely be carried through to the final destination without misunderstanding
1.3.2	Transport contract is signed by both parties	Transport contract is signed by both parties

2.	Project planning - time schedules	Project planning - time schedules
2.1		Production and co-ordination of project dates
2.2	Assembly and packing of cargo - dates	Assembly and packing of cargo - dates
2.3	Delivery time for shipment - dates	Delivery time for shipment - dates
2.4	Transport phase - From place of shipment to final delivery - dates Means of transport - dates Transhipment points - dates	Transport phase - From place of shipment to final delivery - dates Means of transport - dates Transhipment points - dates
2.5	Final delivery at destination - dates	Final delivery at destination dates

	FCL	LCL
3.	Contracts with sub-contractors	Contracts with sub-contractors
3.1	Local inland transport - country of shipment	Local inland transport - country of shipment
3.2	Local terminal work	Local terminal work
3.3	Feeder transport	Feeder transport
3.4	Loading costs/terminal port of loading	Loading costs/terminal port of loading
3.5	Sea transport	Sea transport
3.6	Discharging costs/terminal port of discharge	Discharging costs/terminal port of discharge
3.7	Local inland transport - country of transit/destination	Local inland transport - country of transit/destination
3.8	Possible customs clearance and transit documentation	Possible customs clearance and transit documentation
3.9		Loading and overland transport to final destination
3.10	Final customs clearance and delivery of cargo	Final customs clearance and delivery of cargo
3.11	Assessment of responsibilities for the various sub-contractors in relation to each other and the total transport operation and payment of additional costs or charges if any	Assessment of responsibilities for the various sub-contractors in relation to each other and the total transport operation and payment of additional costs or charges if any
4.	Actual shipment	Actual shipment
4.1	Supply of clean containers and/or other types of unit loads ready for use at shippers' premises	
4.2		Loading and stowage of cargo into containers and/or other unit loads
4.3		Checking that the cargo loaded in the containers or unit loads are in accordance with shippers' packing lists/invoices, i.e. number of packages, weight, volume, short shipment/possible damage, ordinary cargo - reefer - dangerous - heavy lift, etc.
4.4.1	Issuance of multimodal transport documents in exchange of payment of freight (prepaid)	Issuance of multimodal transport documents in exchange of payment of freight (prepaid)

	FCL	LCL
4.4.2		Issuance of other transport documents, loading receipts, customs documents, certificates, etc.
4.4.3	Issuance of transport documents between the MTO and the other transport sub-contractors	Issuance of transport documents between the MTO and the other transport sub-contractors
4.5.	Shipment effected	Shipment effected
4.6	Follow-up on: Road haulier/inland transport operator; Terminal operator; Feeder operator; Loading operation onboard ocean carrier; Checking of container/unit load conditions/lock/ seal	Follow-up on: Road haulier/inland transport operator; Terminal operator; Feeder operator; Loading operation onboard ocean carrier; Checking of container/unit load conditions/lock/ seal
5	Actual transport operation	Actual transport operation
5.1	Follow-up on actual shipment	Follow-up on actual shipment
5.2	Check on date of shipment, expected date of arrival - possible delays	Check on date of shipment, expected date of arrival - possible delays
5.3	Issuance of explicit instructions to receiving agents/forwarding agents/ carriers agents at port of discharge	Issuance of explicit instructions to receiving agents/forwarding agents/ carriers agents at port of discharge
5.3.1	Discharge of goods at port of discharge.	Discharge of goods at port of discharge
5.3.2	Terminal work	Terminal work
5.3.3	Customs procedure and documentation	Customs procedure and documentation
5.3.4	Calling forward and checking on onward transportation of cargo by road or rail	Calling forward and checking on onward transportation of cargo by road or rail
5.4	Arrival of shipment at port of discharge	Arrival of shipment at port of discharge
5.4.1	Follow-up and execution of planned procedure through supervisory staff	Follow-up and execution of planned procedure through supervisory staff
5.4.2	Actual discharge	Actual discharge
5.4.3	Loading operation inland carrier	Loading operation inland carrier
5.4.4	Checking out possible damage	Checking out possible damage
5.4.5	Checking on all relevant documents	Checking on all relevant documents
5.4.6	Shipment continues	Shipment continues
5.5	Arrival of shipment at final destination	Arrival of shipment at final destination

	FCL	LCL
5.5.1	Receiver will produce original multi-modal transport document properly endorsed, if necessary, or in lieu of original MT document, a bank guaranteed indemnity, indemnifying the carrier against any claim on releasing the cargo	Receiver will produce original multi-modal transport document properly endorsed, if necessary, or in lieu of original MT document, a bank guaranteed indemnity, indemnifying the carrier against any claim on releasing the cargo
5.5.2	Arrival of cargo at local terminal/shippers premises	Arrival of cargo at local terminal/shippers premises
5.5.3	Receiver will produce necessary documents for customs clearance	Receiver will produce necessary documents for customs clearance
5.5.4	Cargo is subsequently inspected and cleared by customs officers	Cargo is subsequently inspected and cleared by customs officers
5.5.5	Customs duty and charges are paid	Customs duty and charges are paid
5.5.6	Containers or unit loads with cargo are thereafter delivered at receivers pre-mises	Containers or unit loads with cargo are thereafter delivered at receivers pre-mises
5.6	Unloading procedure	Unloading procedure
5.6.1	Check on: Contents of cargo; Number of packages; Weight and measurement; Possible sign of damage, pilferage and/or theft	Check on: Contents of cargo; Number of packages; Weight and measurement; Possible sign of damage, pilferage and/or theft
5.6.2	5.6.2 Final acceptance of cargo by receiver, who will sign the waybill as evidence of clean receipt	Final acceptance of cargo by receiver, who will sign the waybill as evidence of clean receipt
5.7	In case of damage to the cargo:	In case of damage to the cargo:
5.7.1	Lloyd's cargo surveyor to be called for inspection of cargo	Lloyd's cargo surveyor to be called for inspection of cargo
5.7.2	Damage report is made out, whereafter insurance company is notified	Damage report is made out, whereafter insurance company is notified
5.7.3	Issuance of relevant documentation making specific carrier/agents/forwarding agents or other parties responsible for their obligations for the transportation/clearing/handling and oncarriage of the goods	Issuance of relevant documentation making specific carrier/agents/for-warding agents or other parties responsible for their obligations for the transportation/clearing/handling and oncarriage of the goods
5.7.4	Possible claims are handled, negotiated and concluded	Possible claims are handled, negotiated and concluded

	FCL	LCL
5.7.5	When settlement has been reached, payment of settled amount is made either to shipper or receiver according to the agreed conditions	When settlement has been reached, payment of settled amount is made either to shipper or receiver according to the agreed conditions
5.7.6	Final settlement between MTO/ carriers/agents/forwarding agents and clearing and handling parties/insurance company	Final settlement between MTO/ carriers/agents/forwarding agents and clearing and handling parties/insurance company
5.8	Shipment finally concluded	Shipment finally concluded
5.8.1	Follow-up with shipper/receiver, presentation of invoice covering expenditures which were not covered by the transport contract	Follow-up with shipper/receiver, presentation of invoice covering expenditures which were not covered by the transport contract

Certainty in the complex world of international trade

Since 1936, the ICC's **Incoterms** have been used in commercial contracts worldwide to define both the buyer's and the seller's rights and obligations during the international transport of goods.

When both parties to a transaction specify the delivery as being according to Incoterms, there need be no dispute arising from that aspect of the transaction.

Act Now!

Don't wait another minute to add the new **Incoterms 1990** to your library. To order, simply fill out and mail the order form attached to this brochure. Your copy(ies) will be sent to you.

And remember: if you order **in bulk** you can take advantage of significant discounts and have a copy of **Incoterms 1990** for every key member in your firm.

(Available Spring 1990)

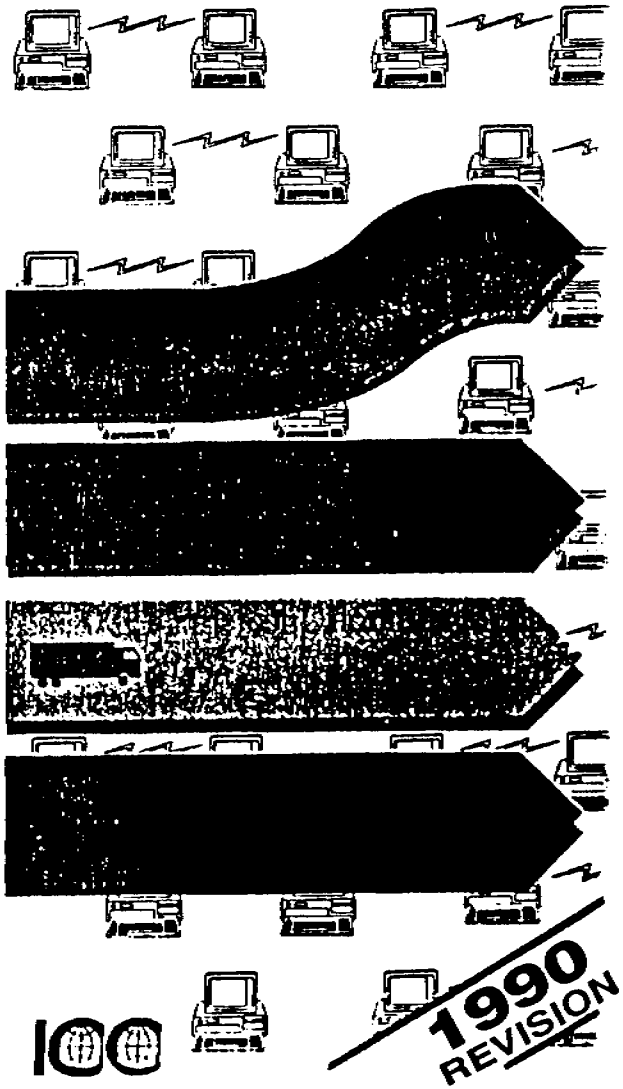
ICC Publication No. 460
bilingual English-French
Format 135 x 240 mm
ISBN No. 92-842-0087-3

THE 13 INCOTERMS 1990	
EXW	Ex Works ... (named place)
FCA	Free Carrier ... (named place)
FAS	Free Alongside Ship ... (named port of shipment)
FOB	Free On Board ... (named port of shipment)
CFR	Cost and Freight ... (named port of destination)
CIF	Cost, Insurance and Freight ... (named port of destination)
CPT	Carriage Paid To ...(named point of destination)
CIP	Carriage and Insurance Paid to ...(named point of destination)
DAF	Delivered At Frontier ...(named point)
DES	Delivered Ex Ship ... (named port of destination)
DEQ	Delivered Ex Quay (duty paid)... (named port of destination)
DDU	Delivered Duty Unpaid... (named point)
DDP	Delivered Duty Paid... (named point)

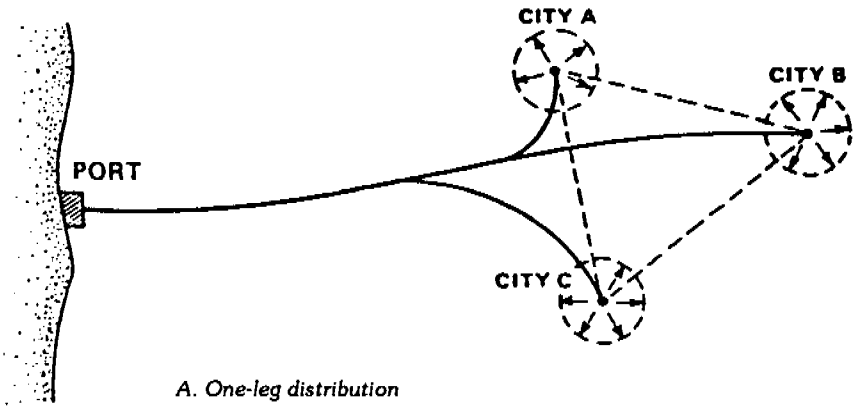
ICC PUBLISHING SA
International Chamber of Commerce
38, Courts Albert 1er
75008 Paris, France
Tel.: (1) 49 53 28 28
Telex: 650770
Telefax: (1) 42 25 36 23

incoterms

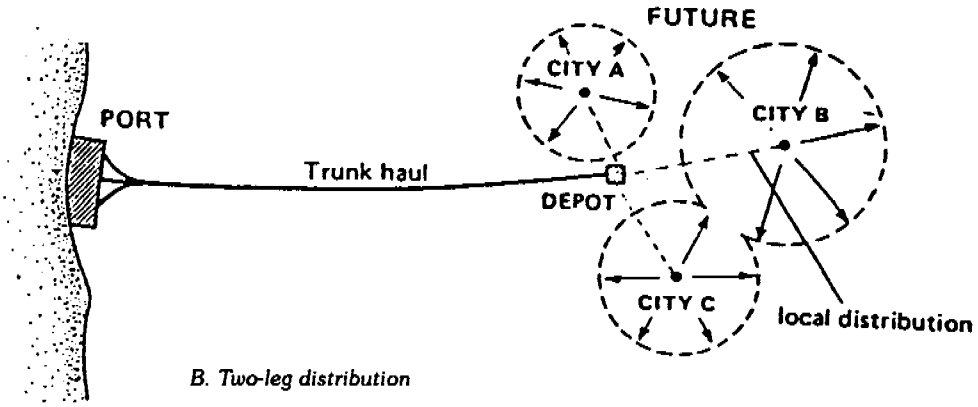
Terms the world trades by



Annex VI: **Effect of Introducing Inland Container Depots**



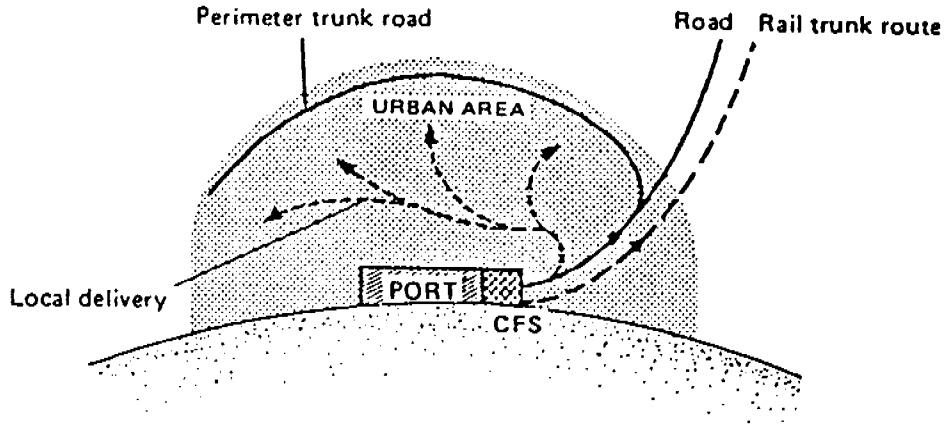
A. One-leg distribution



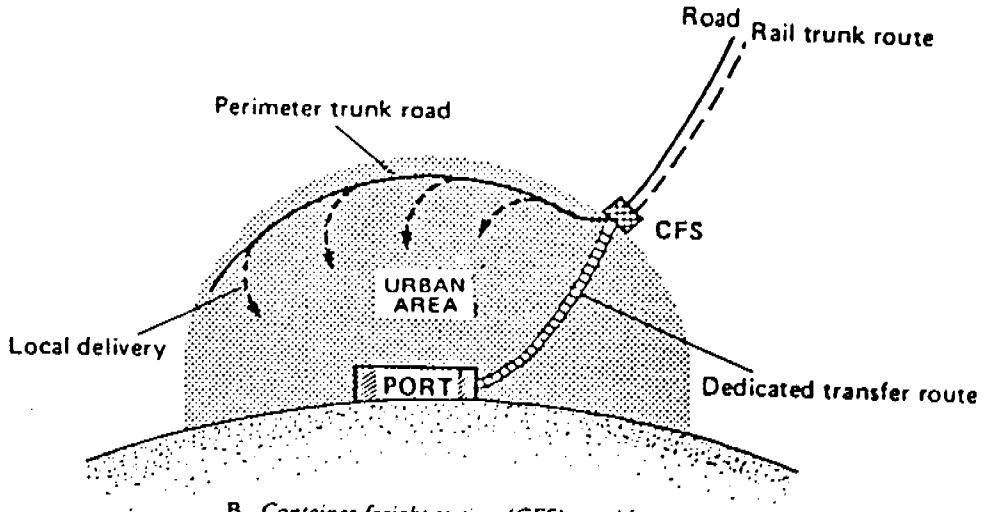
B. Two-leg distribution

Source: UNCTAD, Port Development - a Handbook for Planners in Developing Countries, 2nd ed. revised (TD/B/C.4/175/Rev. 1) (to be issued as a United Nations publication). Part One, chap. IX, figure 40.

Annex VII: Container Freight Station Located Inside or Outside the Port Area: a Comparison



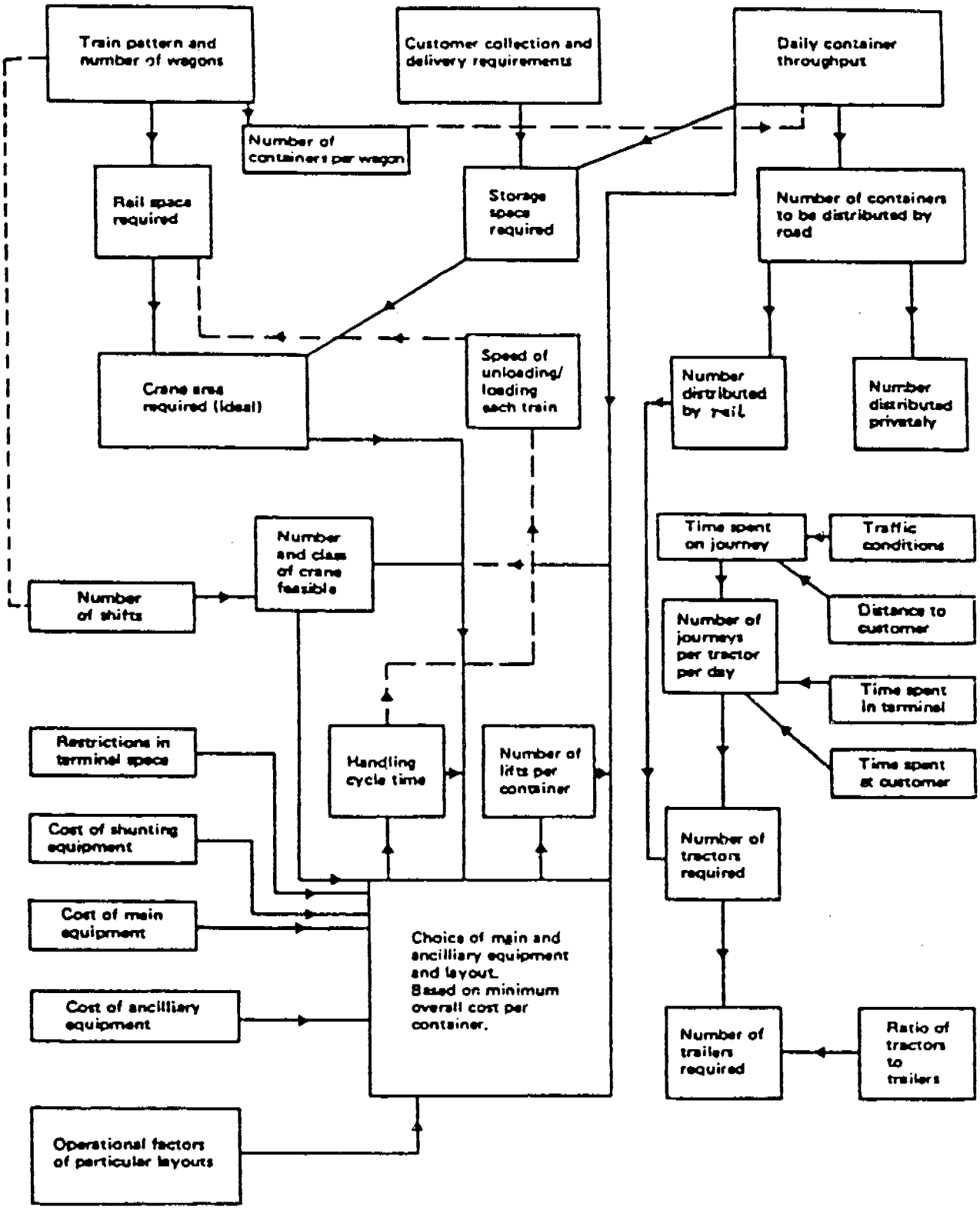
A. *Container freight station (CFS) within port area*



B. *Container freight station (CFS) outside port area*

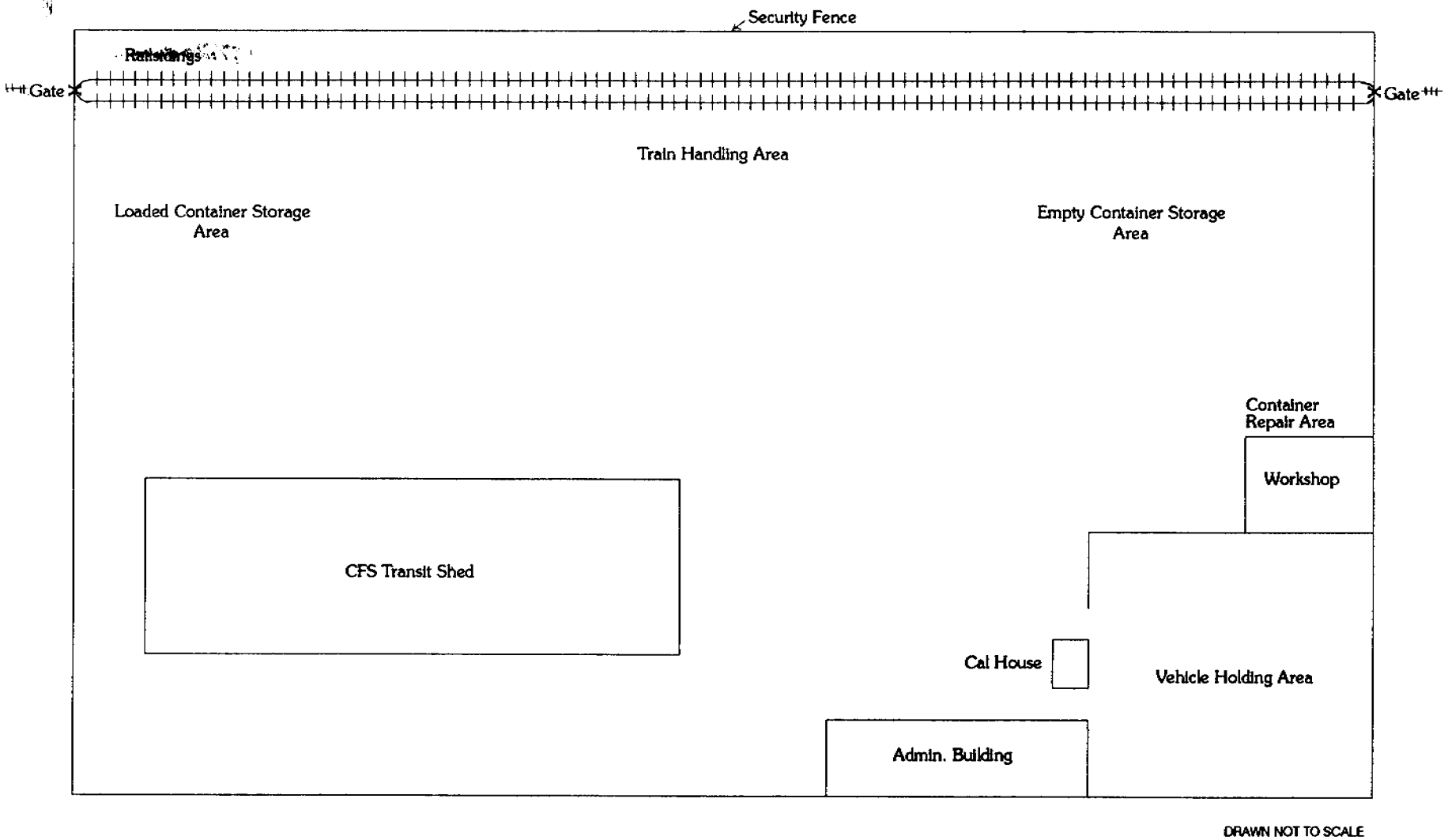
Source: UNCTAD, Port Development - a Handbook for Planners in Developing Countries, 2nd ed. revised (TD/B/C.4/175/Rev. 1) (to be issued as a United Nations publication). Part One, chap. IX, figure 43.

Annex VIII: Operational Analysis Process for Terminal Design and Equipment Selection

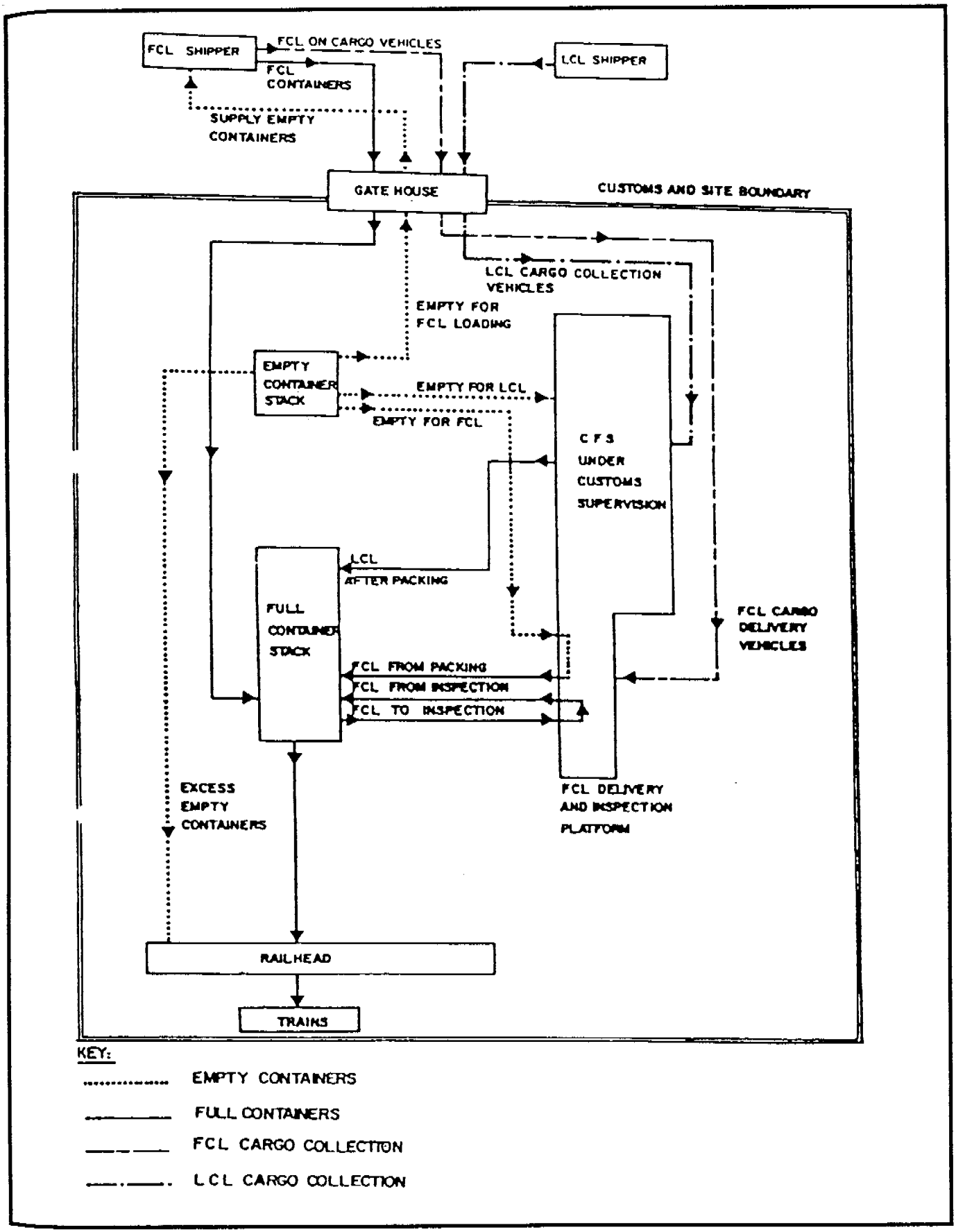


Source: Transmark, 1986

Annex IX: **Conceptual Layout of a Dry Port**

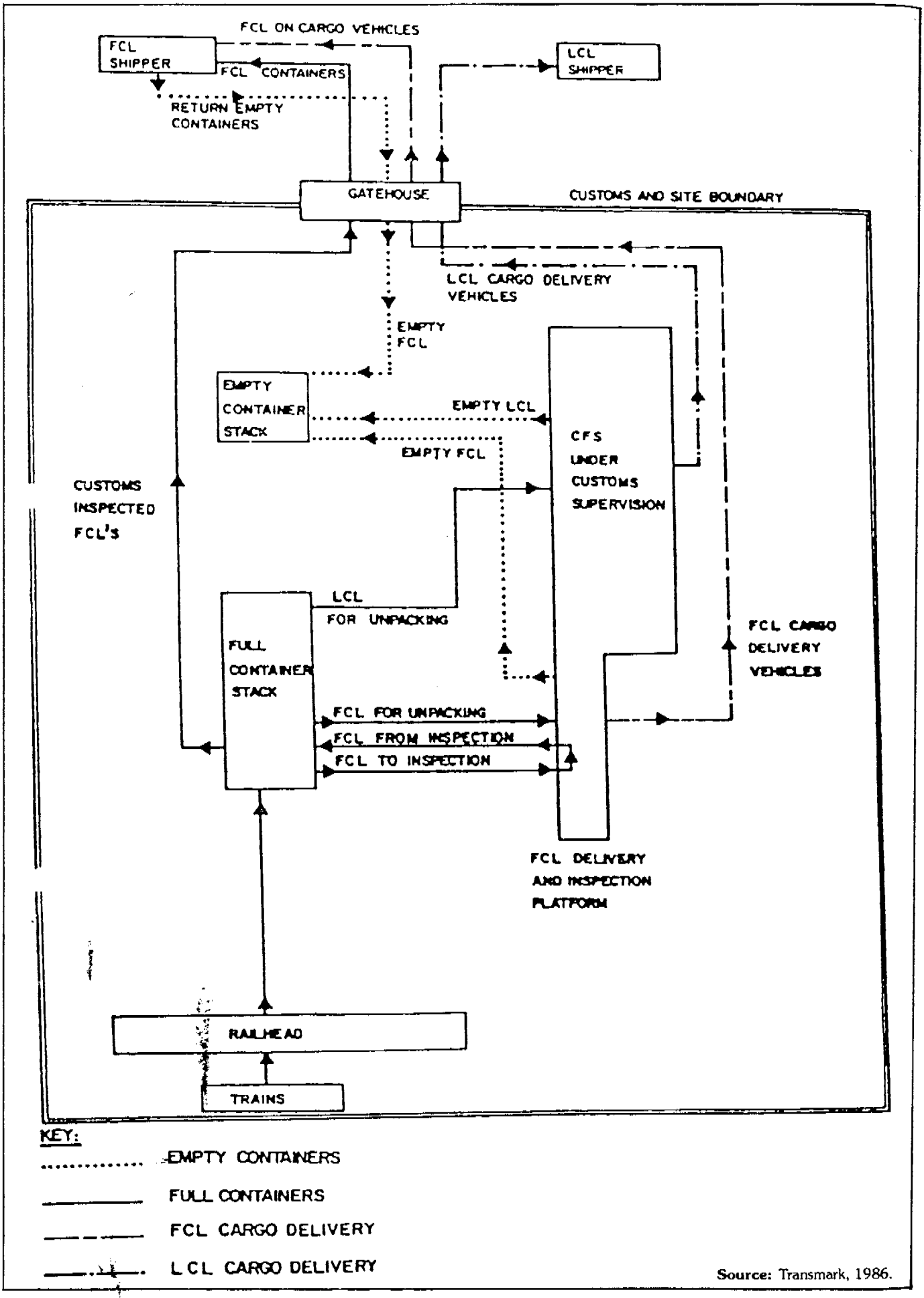


Annex X: **Diagrammatic Representation of Export Flows for a Dry Port**



Source: Transmark, 1986.

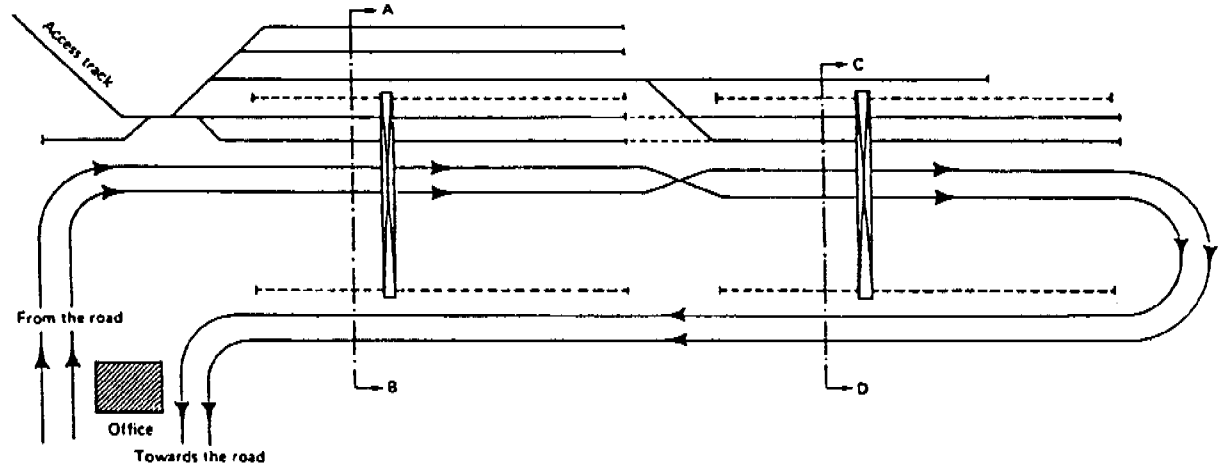
Annex XI: **Diagrammatic Representation of Import Flows for a Dry Port**



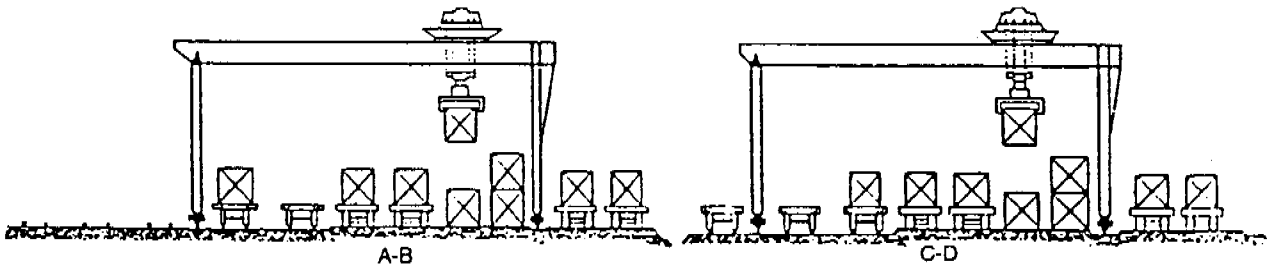
Source: Transmark, 1986.

Annex XII: **Rail Access: Large Internal Terminal**

(a) Ground plan



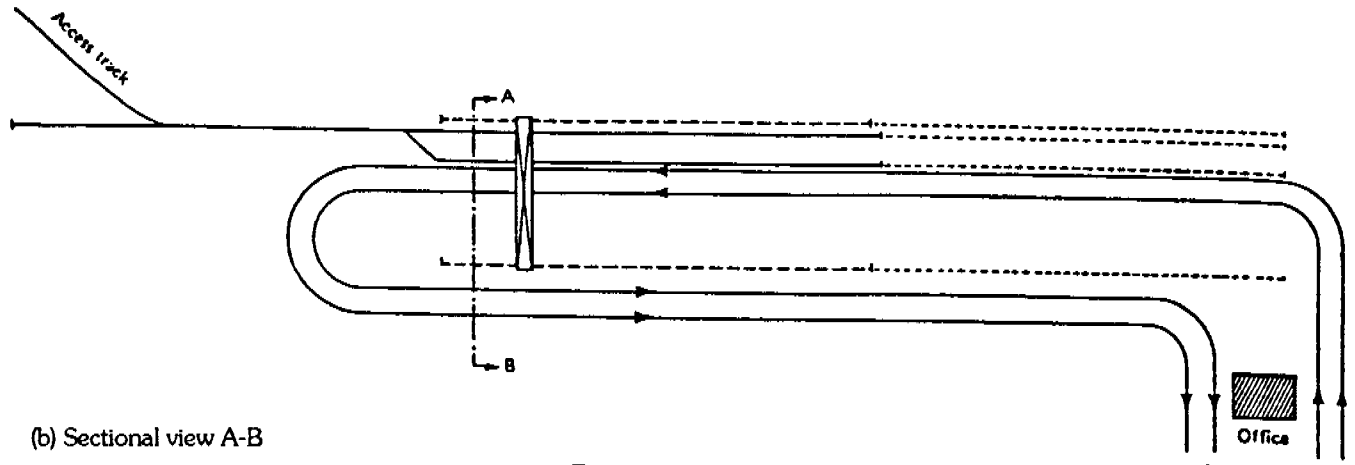
(b) Sectional view A-B, C-D



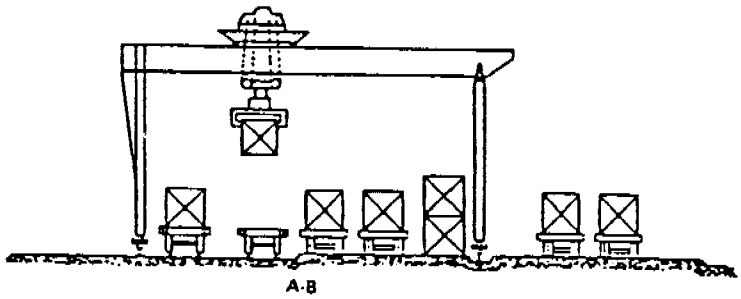
Source: International Union of Railways, Leaflet No. 494 R. 1st ed. (Paris, 1971), plate 2

Annex XIII: **Average Internal Terminal**

(a) Ground plan



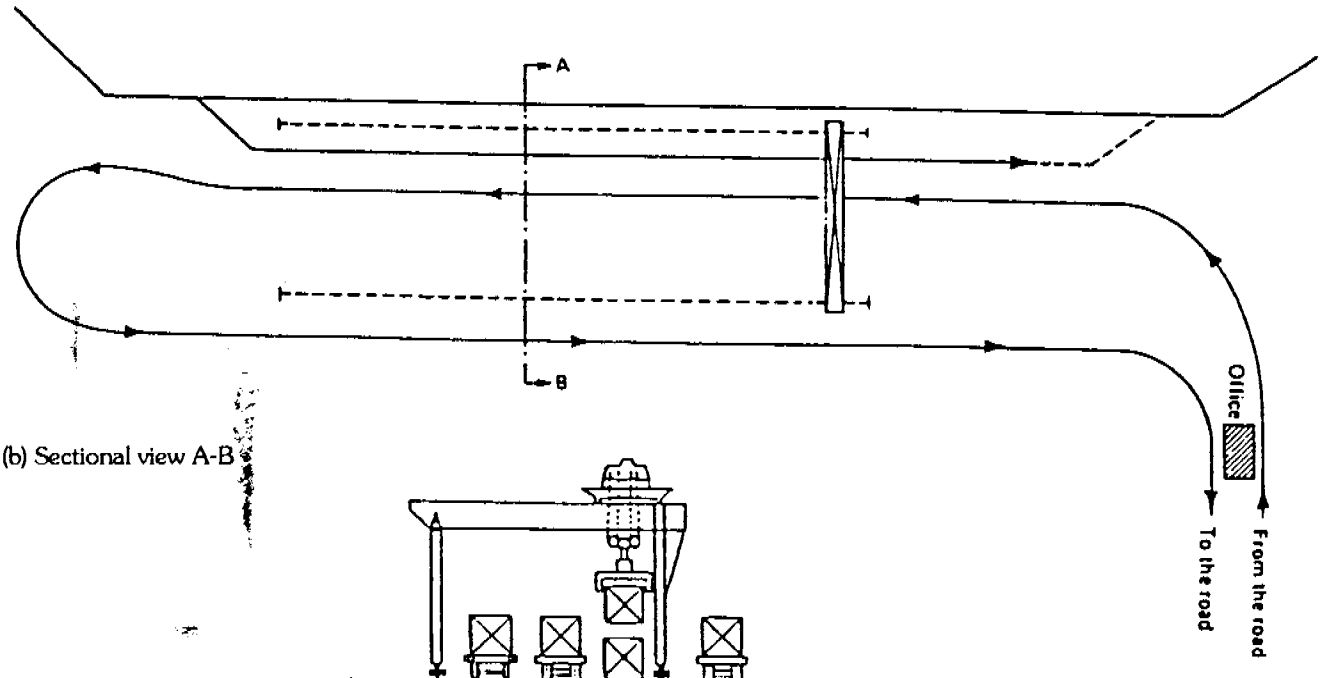
(b) Sectional view A-B



Source: International Union of Railways, Leaflet No. 494 R. 1st ed. (Paris, 1971), plate 5

Annex XIV: **Small Internal Terminal**

(a) Ground plan

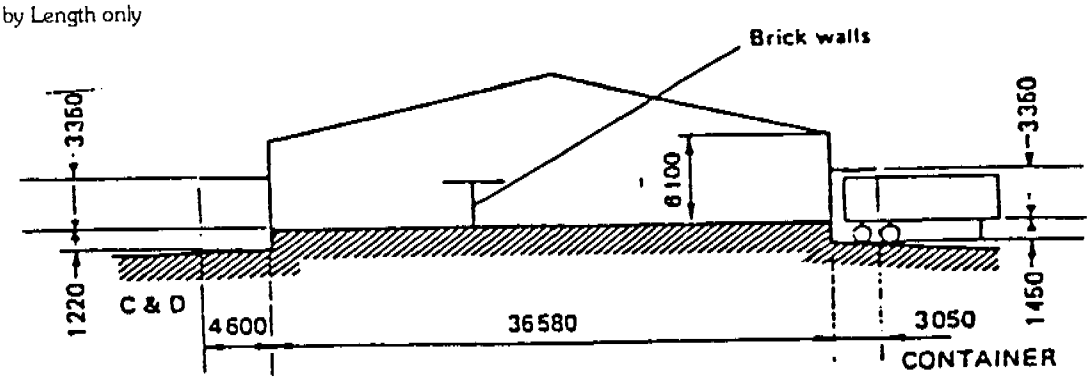


(b) Sectional view A-B

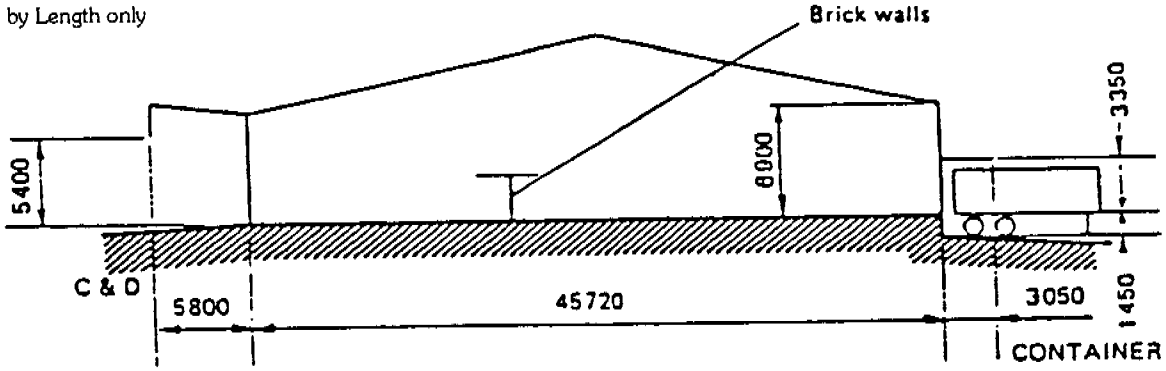
Source: International Union of Railways, Leaflet No. 494 R. 1st ed. (Paris, 1971), plate 6

Annex XV: **Development of CFS Sheds**

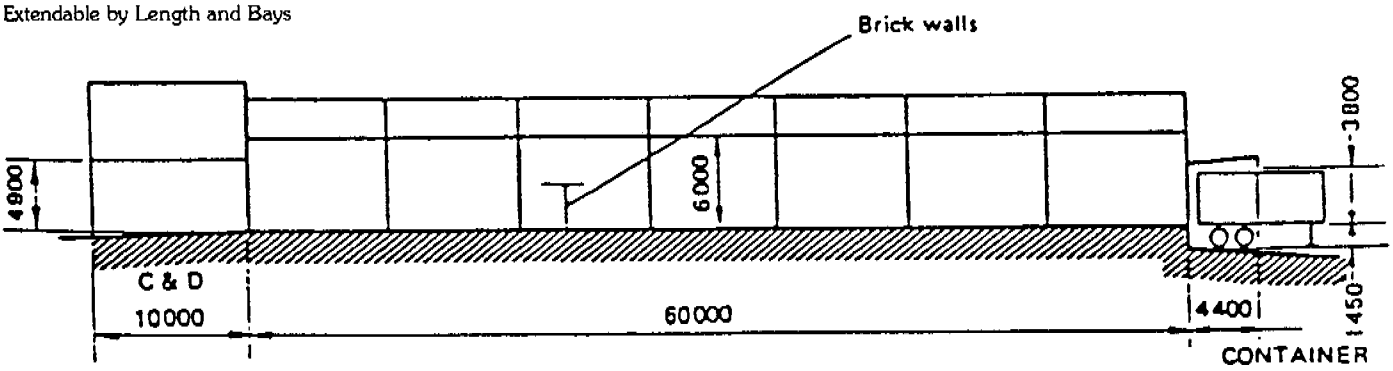
FIRST GENERATION SHED
Extendable by Length only



SECOND GENERATION SHED
Extendable by Length only



THIRD GENERATION SHED
Extendable by Length and Bays



Generation	*Roof light Area*	*Artificial Lighting*	*Fire Protection*	*C & D Doors*	*Container Doors*
First	10 per cent	15 Lux Fluorescent tube	Internal. hosereels	Galv. steel, up + over door	Galv. steel, up + over door
Second	15 per cent	18 Lux Mercury vapour	External. fire hydrants	Internal sliding metal/wood	Galv. steel, up + over door
Third	15 per cent	25 Lux High pressure sodium lamps	External, fire hydrants	External slide metal/wood	Galv. steel, up + over door

Source: K. J. Macdiarmid and D. C. Chambers, "Inland Ports - the UK Container Base System in NPA Containers: their Handling and Transport", National Ports Council Containers - their Handling and Transport; a Survey of Current Practices (London, 1979), p.298.

Annex XVI: **Commodity Stowage Factors**

SITC (Rev. 2)	Commodity	Import		Export	
		Net weight Tons per:			
		container TEU	trailer unit	container TEU	trailer unit
00	Live animals chiefly for food	10.00	20.00	10.00	20.00
011.1	Beef	10.00	20.00	10.00	20.00
011.2	Lamb and mutton	10.00	20.00	10.00	20.00
011.3-011.6, 011.8	Raw meat n.e.s.	10.00	20.00	10.00	20.00
012, 014	Other meat and meat preparations	14.30	20.00	16.70	20.00
023	Butter	16.67	25.00	10.00	25.00
024	Cheese and curd	16.67	25.00	10.00	25.00
022, 025	Milk and eggs	16.67	25.00	10.00	25.00
03	Fish, crustaceans and molluses, and preparations	12.50	20.00	10.00	20.00
041	Wheat	10.00	20.00	7.14	20.00
043	Barley	10.00	20.00	7.14	20.00
044	Maize	10.00	20.00	7.14	20.00
042, 045	Unmilled cereals, n.e.s.	10.00	20.00	7.14	20.00
046-048	Milled cereals	10.00	20.00	7.14	20.00
054.1	Potatoes, fresh	11.11	20.00	14.29	20.00
054.2	Dried beans, peas and leguminous vegetables	11.11	20.00	14.29	20.00
054.4	Tomatoes, fresh	11.11	20.00	14.29	20.00
054.5	Fresh vegetables, n.e.s.	11.11	20.00	14.29	20.00
054.82	Sugar beet and cane	11.11	20.00	14.29	20.00
054.84	Hop cones and lupulin	11.11	20.00	14.29	20.00
054.6, 054.81, 054.88	Other vegetables, n.e.s.	11.11	20.00	14.29	20.00
056	Vegetable preparations	14.29	20.00	11.11	20.00
057.1-057.2	Citrus fruit, fresh or dried	12.50	20.00	12.50	20.00
057.3 (part)	Bananas, fresh	12.50	20.00	12.50	20.00
057.4	Apples, fresh	9.09	20.00	12.50	20.00
057.7 (part)	Nuts, other than desiccated coconut	12.50	25.00	12.50	20.00
057.51, 057.6 (part), 057.9 (exc. 057.96, 057.99)	Fresh fruit n.e.s.	14.29	16.67	14.29	16.67
057.3 (part), 057.52, 057.6	Dried fruit n.e.s.	9.09	20.00	9.09	20.00
058.5	Fruit juices	20.00	20.00	5.88	20.00
058.2, 058.3, 058.6, 058.9	Other fruit preparations	14.29	20.00	11.11	20.00
061.1	Raw sugar	16.67	20.00	11.11	20.00
061.5	Molasses	16.67	20.00	11.11	20.00

SITC (Rev 2)	Commodity	Import		Export	
		Net weight Tons per:			
		container TEU	trailer unit	container TEU	trailer unit
061.2, 061.6, 061.9, 062.0	Other sugar, sugar preparations, confectionery, and honey	16.67	20.00	11.11	20.00
071	Coffee	16.67	16.67	16.67	16.67
072, 073	Cocoa and chocolate	14.29	16.67	12.50	16.67
074	Tea and mate	9.09	11.11	5.00	11.11
075	Spices	9.09	12.50	9.09	12.50
08	Feedingstuffs for animals (not including unmilled cereals)	14.29	20.00	14.29	20.00
09	Miscellaneous edible products and preparations	14.29	20.00	11.11	20.00
112.12a	Wine in bulk	20.00	16.67	16.67	16.67
112.12b	Wine in bottles	7.14	12.50	5.56	12.50
112.3a	Beer in bulk	20.00	16.67	16.67	16.67
112.3b	Beer in bottles	7.69	12.50	6.67	12.50
112.1	Whisky	7.69	12.50	6.67	12.50
112.42, 112.49	Other spirits	7.69	12.50	6.67	12.50
111, 112.11, 112.13, 112.2	Other beverages	7.69	12.50	6.67	12.50
12	Tobacco and tobacco manufactures	9.09	16.67	5.88	16.67
21	Hides, skins and furskins, raw	16.67	20.00	16.67	16.67
222.2	Soya beans	11.11	20.00	11.11	20.00
222.1, 222.3-222.6	Other oilseeds, nuts	11.11	20.00	11.11	20.00
232	Natural rubber	14.29	20.00	12.50	20.00
233	Other crude rubber	14.29	20.00	12.50	20.00
244-246	Cork, fuelwood, pulpwood	11.11	25.00	11.11	25.00
247.1, 248.2	Lumber, coniferous (softwood)	11.11	25.00	11.11	25.00
247.2, 248.3	Lumber, non-coniferous (hardwood)	12.50	25.00	12.50	25.00
247.9, 248.1	Pitprops, railway sleepers	11.11	25.00	11.11	25.00
25	Pulp and waste paper	10.00	25.00	10.00	20.00
263	Cotton	14.29	20.00	14.29	20.00
266, 267	Man-made fibres	6.67	14.29	8.33	16.67
268	Wool and other animal hair	12.50	16.67	7.69	16.67
261, 264, 265, 269	Textile fibres n.e.s.	6.67	14.29	8.33	14.29
271	Phosphates and other natural crude fertilisers	16.67	20.00	16.67	14.29
273.1, 273.2	Constructional stone	16.67	20.00	16.67	14.29
273.3	Sand	16.67	20.00	16.67	14.29

SITC (Rev 2)	Commodity	Import		Export	
		Net weight Tons per:			
		container TEU	trailer unit	container TEU	trailer unit
273.4	Gravel and crushed stone	16.67	20.00	16.67	14.29
274	Sulphur and iron pyrites (unroasted)	16.67	20.00	16.67	14.29
277.22	Natural abrasives	16.67	20.00	16.67	14.29
278.21	Clays	10.00	20.00	16.67	20.00
278.23, 278.24	Dolomite and magnesite	16.67	20.00	16.67	14.29
278.3	Salt	10.00	20.00	16.67	20.00
278.4	Asbestos	10.00	20.00	10.00	20.00
278.5	Quartz, mica, feldspar and fluorspar	16.67	20.00	16.67	14.29
278.6	Slag and ash	16.67	20.00	16.67	14.29
277.1, 277.21, 278.22, 278.9	Other crude minerals	16.67	20.00	16.67	14.29
281	Iron ore and pyrites (roasted)	14.29	20.00	16.67	20.00
282	Iron and steel, waste and scrap	16.67	20.00	16.67	20.00
287.3	Aluminium ores and concentrates	14.29	20.00	16.67	20.00
287.7	Manganese ores and concentrates	14.29	20.00	16.67	20.00
286, 287.1, 287.4, 287.5, 287.6, 287.9, 288, 289	Other ores and scrap	14.29	20.00	16.67	20.00
29	Crude animals and vegetable materials, n.e.s.	14.29	20.00	11.11	20.00
322	Coal, lignite and peat	16.67	25.00	16.67	25.00
59	Chemical materials and products, n.e.s.	12.50	20.00	11.11	20.00
61	Leather, leather manufactures, n.e.s. and dressed furskins	7.69	20.00	7.69	20.00
625	Tyres and tubes	7.14	12.50	6.67	16.67
621, 628	Rubber manufactures n.e.s.	5.88	20.00	5.88	16.67
634.32	Reconstituted wood	10.00	25.00	10.00	25.00
634.2, 634.41, 634.32	Plywood, blockboard, etc.	10.00	25.00	10.00	25.00
633, 634.1, 634.31, 634.43	Other wood and cork manufactures	5.00	10.00	5.00	10.00
641.1	Newsprint	9.09	20.00	11.11	20.00
641.2	Printing and writing paper	10.00	20.00	10.00	20.00
641.3	Kraft paper	11.11	20.00	11.11	20.00
641.6	Building board	5.00	20.00	7.69	20.00
641.5, 641.7, 641.8, 641.9	Other paper and board	5.00	20.00	7.69	20.00
642	Articles of paper and board	5.00	20.00	7.69	20.00
651.21	Wool tops	10.00	20.00	12.50	20.00
651 (the rest)	Other yarn and thread	12.50	14.29	5.56	16.67

SITC (Rev 2)	Commodity	Import		Export	
		Net weight Tons per:			
		container TEU	trailer unit	container TEU	trailer unit
652-659	Fabrics and made-up articles	7.69	14.29	5.00	16.67
661.2	Cement	14.29	20.00	10.00	20.00
661.1, 661.3, 661.8, 662, 663.31, 663.32, 663.39, 663.5	Lime and other building materials	14.29	20.00	10.00	20.00
664	Glass	12.50	20.00	12.50	16.67
663.1, 663.2, 663.33, 663.7, 663.8, 663.9, 665, 666, 667	Other non-metallic mineral manufactures	12.50	20.00	12.50	20.00
323	Briquettes, coke, and retort carbon	16.67	25.00	16.67	25.00
333	Crude petroleum (except by pipeline)	16.67	25.00	16.67	25.00
334	Petroleum products, refined	12.50	16.67	11.11	20.00
335.2, 335.3	Tar and crude chemicals of coal and petroleum	12.50	16.67	11.11	20.00
335.1, 335.4	Other non-energy petroleum by-products	12.50	16.67	11.11	20.00
34	Gas, natural and manufactured (excluding pipeline)	12.50	16.67	11.11	16.67
41	Animal oils and fats	7.69	25.00	7.69	25.00
42	Fixed vegetable oils and fats	7.69	25.00	7.69	25.00
43	Animal and vegetable oils and fats, processed, and waxes of animal or vegetable origin	7.69	25.00	7.69	25.00
51	Organic chemicals	12.50	20.00	11.11	20.00
522.22	Sulphuric acid	14.29	20.00	11.11	20.00
522.51	Ammonia	14.29	20.00	11.11	20.00
522.52, 522.53	Caustic soda	14.29	20.00	11.11	20.00
523.23	Soda ash	14.29	20.00	11.11	20.00
52 (the rest)	Inorganic chemicals n.e.s.	14.29	20.00	11.11	20.00
53	Dyeing, tanning and colouring materials	14.29	20.00	11.11	20.00
54	Medicinal and pharmaceutical products	5.56	14.29	5.00	12.50
55	Essential oils and perfume materials: toilet, polishing and cleansing preparations	10.00	16.67	7.14	16.67
562.1	Nitrogenous fertilisers	16.67	20.00	14.29	14.29
562.2	Phosphatic fertilisers	16.67	20.00	14.29	14.29
562.3	Potassic fertilisers	16.67	20.00	14.29	14.29
562.9	Manufactured fertilisers n.e.s.	16.67	20.00	14.29	14.29
57	Explosives and pyrotechnic products	10.00	10.00	10.00	10.00
58	Artificial resins and plastic materials, and cellulose esters and ethers	9.09	20.00	9.09	20.00
671.2	Pig iron	11.11	25.00	11.11	25.00

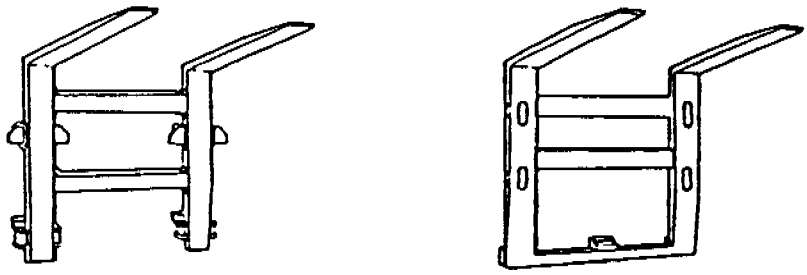
SITC (Rev 2)	Commodity	Import		Export	
		Net weight Tons per:			
		container TEU	trailer unit	container TEU	trailer unit
671.3, 672	Other iron and steel in primary form	11.11	25.00	11.11	25.00
671.6	Ferro-alloys	16.67	25.00	14.29	20.00
673	Iron and steel bars, rods, etc.	16.67	20.00	14.29	20.00
674	Iron and steel plates, sheets, etc.	14.29	20.00	14.29	20.00
675	Iron and steel hoop and strip	16.67	20.00	14.29	20.00
676	Iron and steel rail	11.11	20.00	11.11	20.00
677	Iron and steel wire	12.50	20.00	12.50	20.00
678	Iron and steel tubes, pipes and fittings	10.00	20.00	10.00	20.00
679	Iron and steel castings and forgings	11.11	20.00	11.11	20.00
682	Copper	14.29	20.00	12.50	20.00
684	Aluminium	10.00	20.00	12.50	20.00
685	Lead	14.29	20.00	14.29	20.00
686	Zinc	14.29	20.00	14.29	20.00
681, 683, 688, 689	Non-ferrous metals n.e.s.	14.29	20.00	14.29	20.00
691	Finished structural parts and structures	9.09	20.00	12.50	20.00
692-697, 699, 951, 961, 962, 971, 974	Metal manufactures n.e.s.	9.09	20.00	12.50	20.00
71	Power generating machinery and equipment	7.69	14.29	12.50	12.50
721	Agricultural machinery	7.14	12.50	7.69	14.29
723.41-723.46, 723.9	Excavating machinery	11.11	16.67	12.50	16.67
722, 723.3, 723.48, 724-728	Other machinery specialised for particular industries	11.11	16.67	12.50	16.67
73	Metalworking machinery	8.33	14.29	10.00	14.29
74	General industrial machinery and equipment, n.e.s. and machine parts n.e.s.	9.09	14.29	12.50	14.29
75	Office machines and automatic data processing equipment	4.00	11.11	9.09	11.11
76	Telecommunications and sound recording and reproducing apparatus and equipment	5.00	10.00	5.00	10.00
77	Electrical machinery, apparatus and appliances, n.e.s. and electrical parts (including non-electrical counterparts, n.e.s. of electrical houshold type equipment	5.88	11.11	10.00	12.50
781a	Cars - assembled	1.30	3.00	1.59	3.00
781b	Cars - unassembled	5.56	12.50	6.67	12.50
782, 783, 785.1	Other road motor vehicles	1.30	3.00	1.59	3.00
784	Parts and components of road motor vehicles	7.69	16.67	5.56	16.67

SITC (Rev 2)	Commodity	Import		Export	
		Net weight Tons per:			
		container TEU	trailer unit	container TEU	trailer unit
785.2, 785.31, 786.1, 786.81	Non-motorised road vehicles	1.30	3.00	1.59	3.00
785.39, 786, 789	Parts and components of non-motorised road vehicles	7.69	16.67	5.88	16.67
812.1	Boilers and radiators	4.00	9.09	4.00	9.09
812.2, 812.4	Sanitary, plumbing and lighting fixtures, n.e.s.	4.00	9.09	4.00	9.09
82	Furniture and parts	7.14	12.50	3.00	20.00
83	Travel goods, handbags and similar containers	4.00	7.69	4.00	7.69
84	Articles of apparel and clothing accessories	3.00	5.56	3.45	5.56
85	Footwear	5.00	11.11	5.00	11.11
87	Professional, scientific and controlling instruments and apparatus, n.e.s.	3.00	11.11	3.00	11.11
88	Photographic apparatus, equipment and supplies and optical goods, n.e.s.; watches and clocks	11.11	14.29	8.33	16.67
892	Printed matter	11.11	25.00	7.14	20.00
893-899	Other miscellaneous manufactured articles	7.69	16.67	7.69	16.67

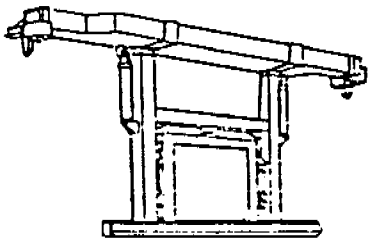
Source: "UK Unitised TRA Statistics, 1987", TRANSMODAL.

Annex XVII: **Fork-Lift Attachments for the Carriage of Containers**

Inverted forks

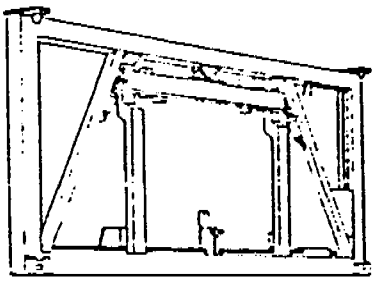


Side lift frame for empty containers



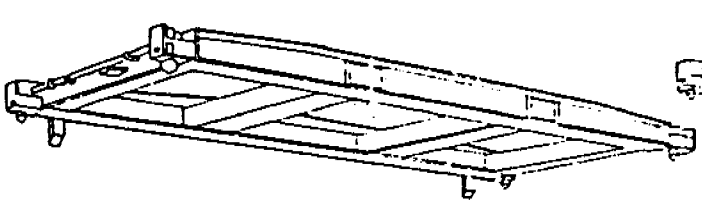
Hydraulically adjustable 20-40 ft. Levelling angle ± 2.5°.

Side-lift frames for 20 ft containers

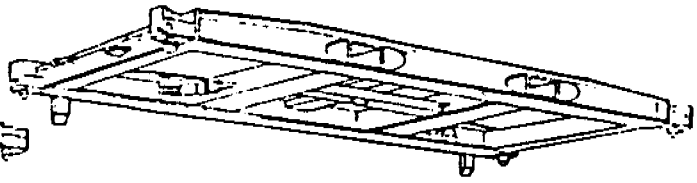


Levelling angle ± 2.5°. Hydraulically adjustable for 8 ft, 8 ft 6 in.and 9 ft containers

Top-lift frames for 20 ft or 40 ft containers

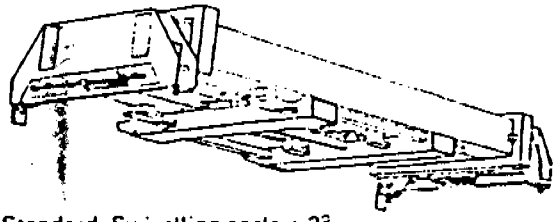


Fixed

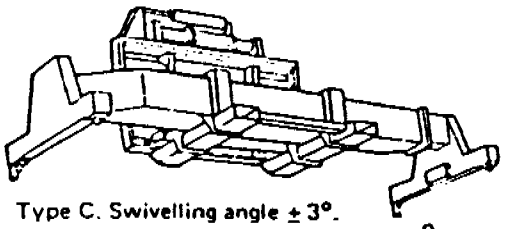


Swivelling angle ± 3°.

Hydraulically adjustable top-lift frames for 20-40 ft containers



Standard. Swivelling angle ± 3°.

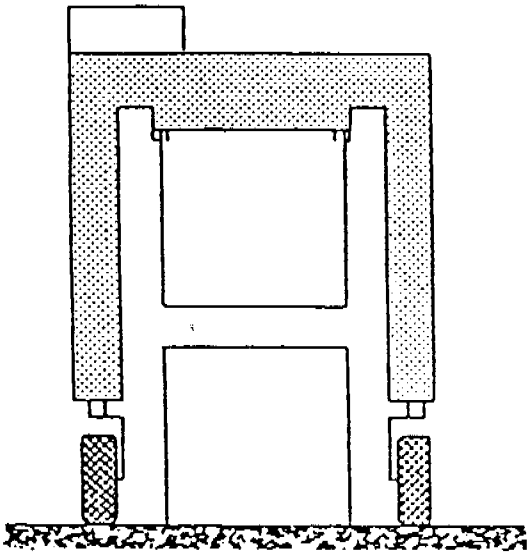


Type C. Swivelling angle ± 3°.

Type CS. Swivelling angle ± 3°. Long reach $^{-0}_{-200}$ mm.

Source: Kalmar LMV, Dimensions and Data (Ljungby, Sweden)

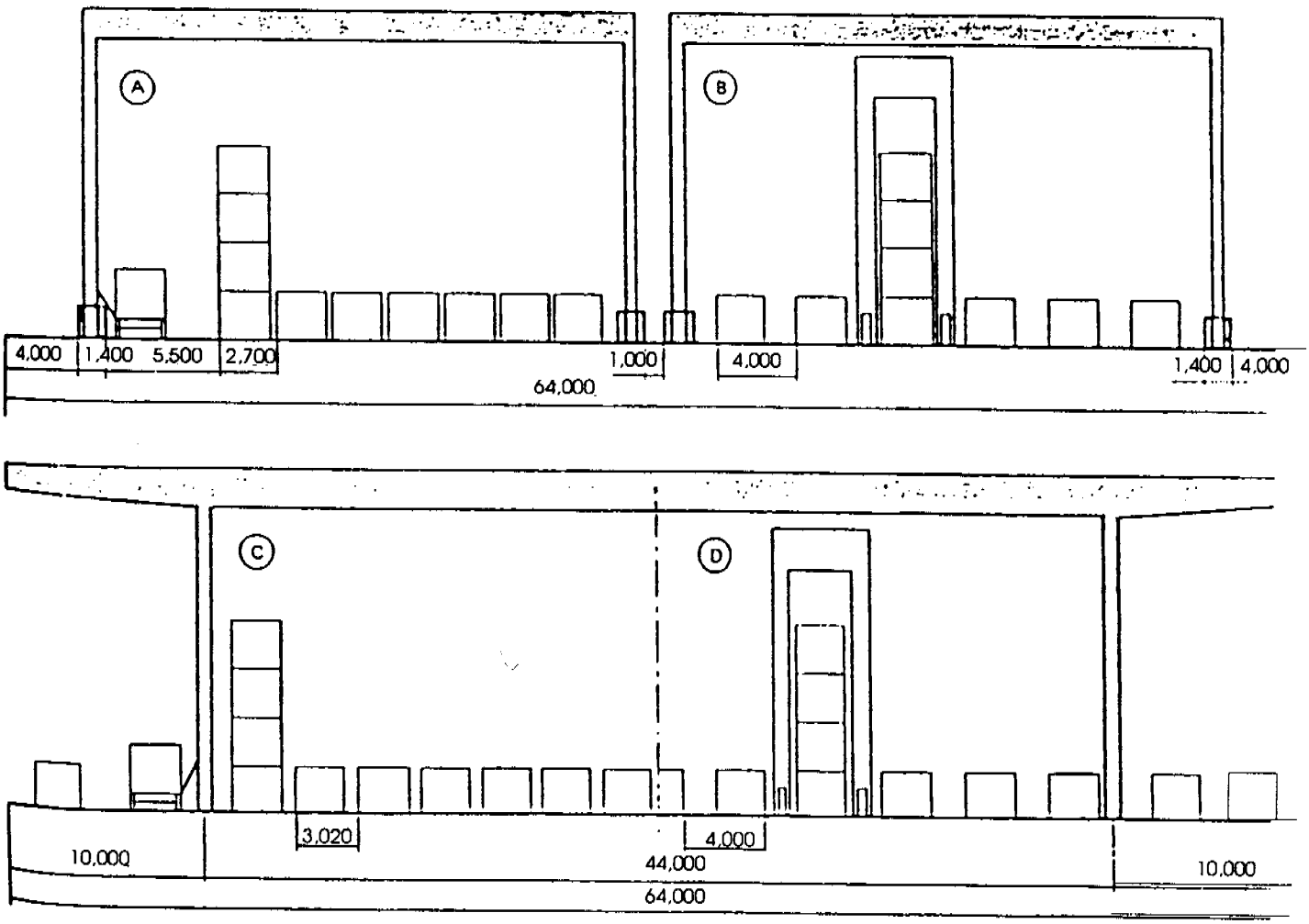
Annex XVIII: **Straddle Carrier**



Straddle carriers (or a basic design) exist in a number of basic versions which differ according to stacking capabilities, width of carriers and hoisting systems. Existing carriers can stack up to four-high (one over three), three-high carriers being most frequently used. For low throughput terminals, smaller versions stacking only two-high are available. The narrow carrier has an internal width of 3 metres, the wide one of 3.5 metres. While the narrow type guarantees better space utilization in storage operations, the wide carrier can also be used for transfers to and from railcars and reduces the possibility of damage to the container. Some typical characteristics of both types of carrier are:

Stacking capacity	2.4 high
Carrying capacity	45 tons
Travelling speed	15-20 km/h
Hoisting speed	10-15 m/min.

Annex XIX: **Employment of Yard Gantry Cranes**

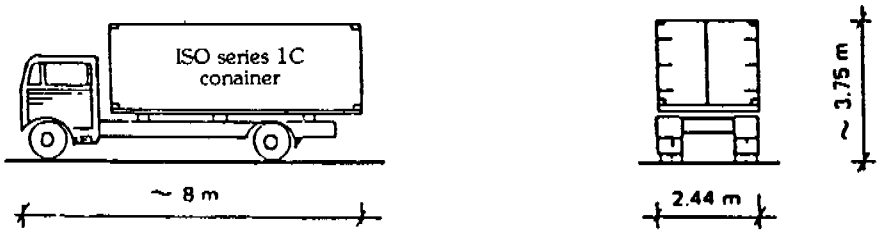


A = Rubber-tyred gantry combined with trailers
B = Rubber-tyred gantry combined with straddle carriers
C = Rail-mounted gantry combined with trailers
D = Rail-mounted gantry combined with straddle carriers

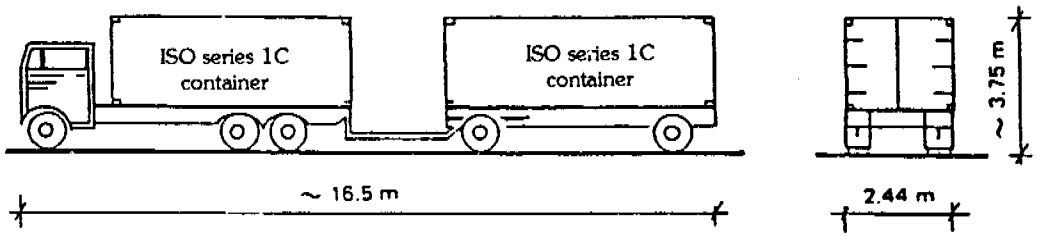
Source: W. A. de Geus, "New Thinking in Container Handling Equipment Analysis for Stacking Containers," Rotterdam, Nellen Kraanbouw, 1981

Annex XX: **Road Vehicles for the Carriage of Containers**

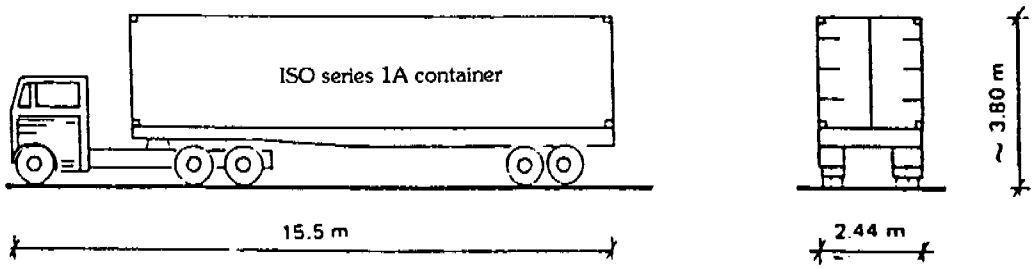
1. Single Truck Units



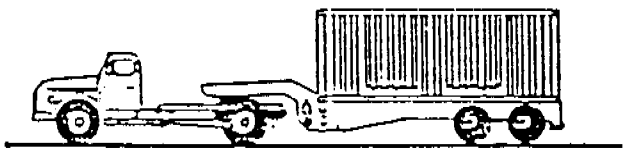
2. Truck Trailer Units



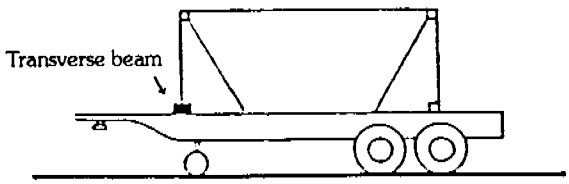
3. Semi-Trailer Units



4. Goose-neck Semi-Trailer Units



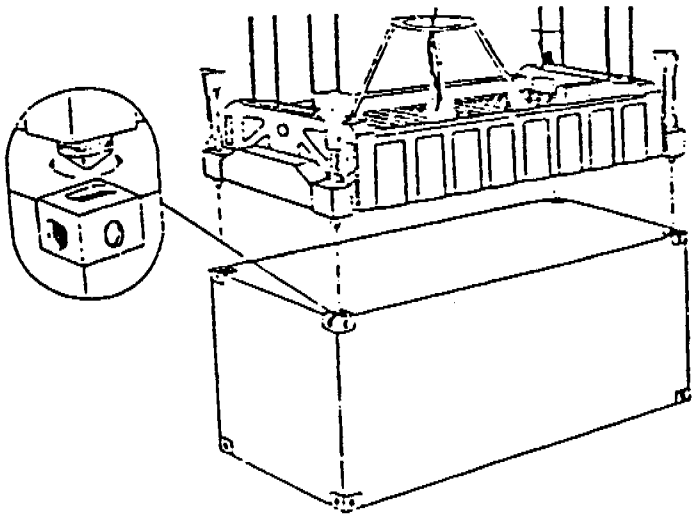
5. Lashing of Containers on Conventional Semi-Trailers



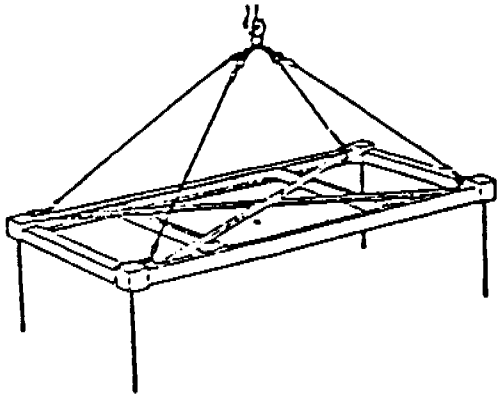
Source: Physical Requirements of Transport Systems for Large Freight Containers (United Nations Publications Sales No. E. 73 VIII.4)

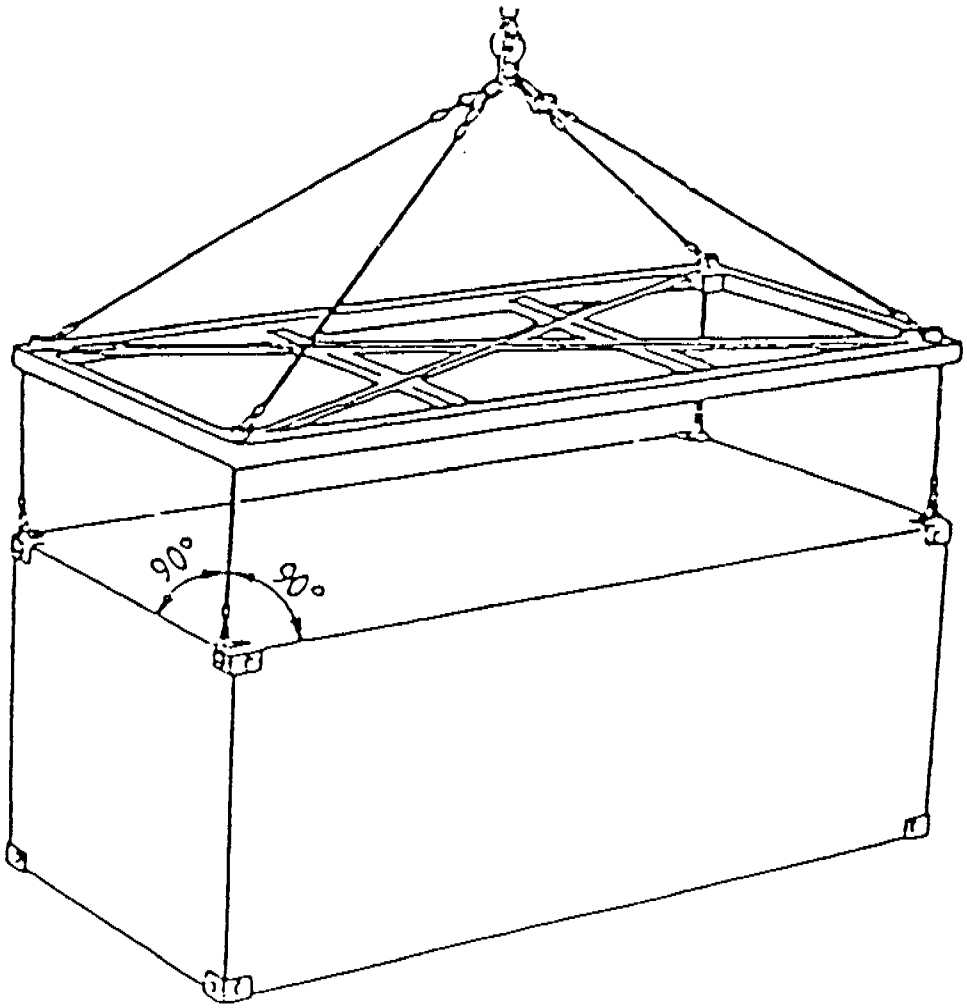
Annex XXI: **Means of Hoisting Containers**

Spreader with twistlocks

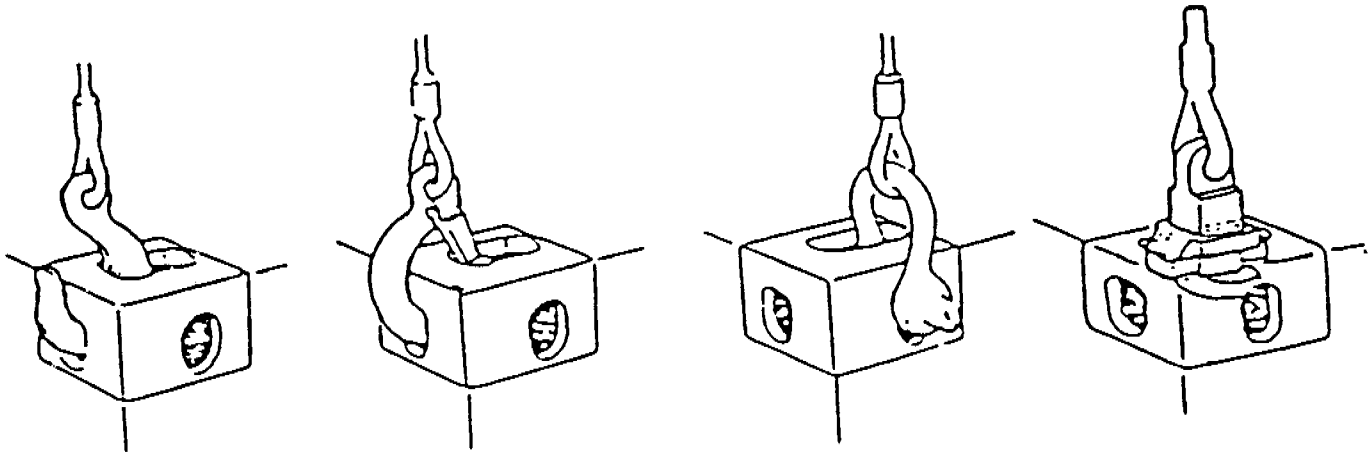


Spreader with hooks, shackles or hand-engaged twist locks





Example of lifting by spreader equipment with hooks, shackles or hand-engaged twist lock attachment

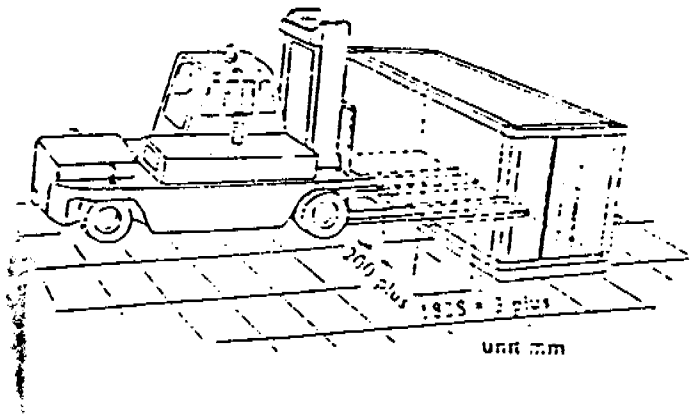


a) Ordinary hook b) Safety hook c) Shackle d) Hand-engaged twist lock

- Examples of attachments

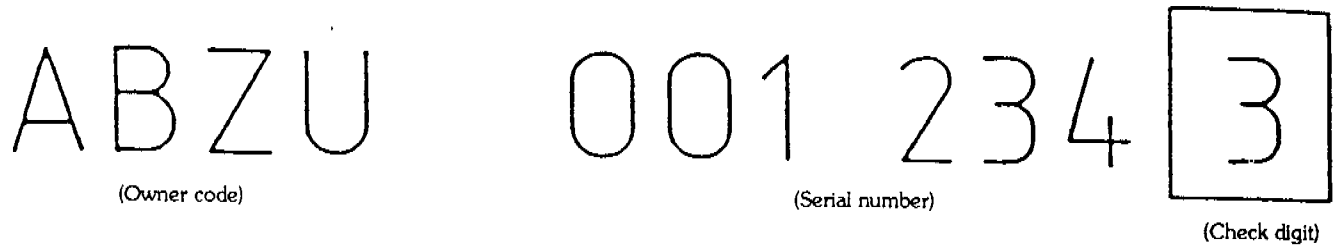
Recommended lifting method.

Handling a Container by Fork-Lift Truck

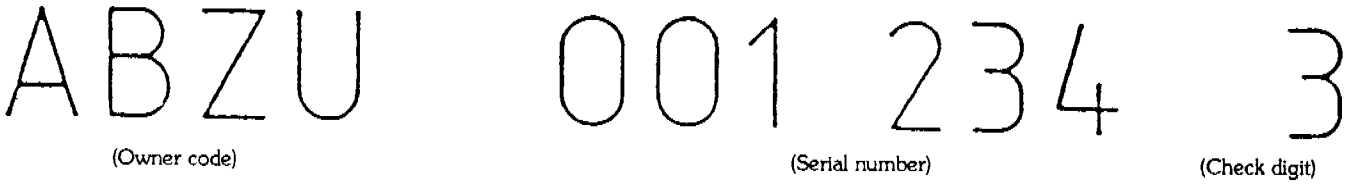


Example of correct handling method by fork-lift pockets

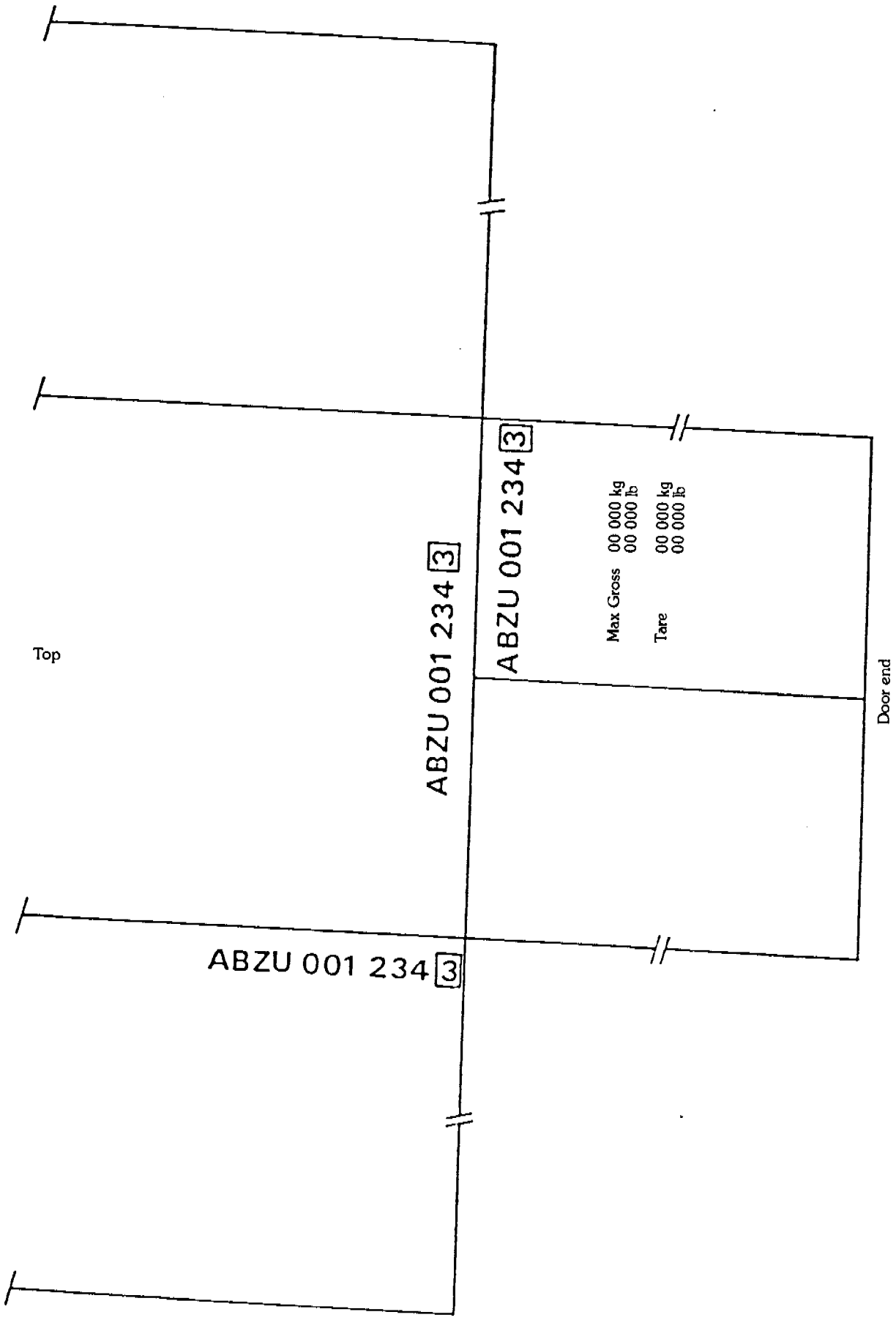
Annex XXII: **Mandatory Identification Codes for Containers**



Mandatory identification code.



Mandatory identification, and optional country size, type codes.


ABZU 001 234 3
ABZU 001 234 3
ABZU 001 234 3
Max Gross 00 000 kg
00 000 lb
Tare 00 000 kg
00 000 lb
Top
Door end

REFERENCES AND DATA SOURCES

Amin, M., Willetts, D., and Matheson, A., (1987) *Railway Across the Equator*, Bodley Head, London.

Cargo Systems, (July 1985).

Containerisation International, (December 1989).

Development Research and Technological Planning Centre, (1988) *Freight Service Planning and Marketing - A Case Study of the Egyption Railways. Final Report* (2 volumes), Arab Republic of Egypt, Ministry of Transport, National Egyptian Railway Authority.

The Economist, (July 1989).

Haggett, P., Cliff, A. D., and Frey, A., (1977) *Locational Models and Locational Methods*, Arnord Press.

Hyuth, Y., (1987) *Intermodality: Concept and Practice*, Lloyd's of London Press.

ICC Incoterms, (1990).

Kalmar, L. M. W., (1987) *Dimensions and Data*, Sweden.

Kenya Ports Authority, (1989) *KPA ICD Handbook*, Embakasi, Nairobi.

Kenya Ports Authority, (1987) *Ten Year Strategy for Port Development*.

Lloyd's List, (February, 1990) *Box Handling Rates on the River Rhine*.

Lloyd's List, (November, 1989) *East Africa Special Report*.

Lloyd's List, (August 1987) *Egypt Special Report*.

Rail International, (May 1978).

Rites Report, (1986) *Inland Container Depots in India*.

Sadek, M., and Serag, S., (1990) *Imported and Exported Freights at Port Said Port*, Suez Canal University.

Transmark, (1986) *ICD Feasibility Study*, Bashtil, Cairo.

Transmodal, (1987) *UK Unitised Trade Statistics*.

UNCTAD, (1987) *Handbook on International Trade and Development Statistics*.

UNCTAD, (1985) *Trainmar Handbook*.

UNCTAD, (1984) *Multimodal Transport and Containerisation*, TD/B/C.4/238/Rev. 1.

UNCTAD, (1982) *Multimodal Transport and Containerisation*, TD/B/C.4/238/Supplement 1, Part Five: Ports and Container Depots.

UNDP/UNCTAD, (1986) Project RAF/77/017.