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FIRST REPORT ON CONTAINERS

by

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PROBLEMS OF OVERSEAS CONTAINER TRAFFIC

INTRODUCTION

Everybody agrees that containers are a "good thing"; the actual advantages of transporting cargo, and in particular, dry cargo, in containers over other forms of transport have, to our knowledge, nowhere been stated in quantitative terms.

It is claimed that containers will reduce the turn-round time of ships, ease congestion in the docks, speed-up total transit time of cargo, reduce the risk of pilferage, reduce packaging cost and reduce total handling effort in all stages of transit.

Given that all these advantages are real, it is obvious that they do not accrue in equal measure to all parties concerned in the movement of goods from consignor to consignee. There is indeed a likelihood of a conflict of interest between these parties.

In this report we shall try to delineate the various problem areas, indicate the quantitative information that needs to be collected in order to decide how to solve these problems and outline an approach to such solutions.

2. CARGO

All dry cargo, such as, parts, small machines, consumer durables, goods in boxes, sacks, bottles, bales etc, are candidates for transport in container.

A container load is of the order of 10-30 ton net. On the other hand, it appears that an average shipment parcel, originating or arriving in the U.K. is of the order of 2 tons, where a parcel is defined as a shipment from a single consignor to a single consignee. Further not only weight, but volume and dimension of each parcel must be considered. There are, of course a considerable number of single parcels big enough to make up a container load.

Nevertheless, if most dry cargo is containerisable and containers have the advantages claimed for them, then, the higher the proportion of the total that is shipped in containers, the better.

There is thus a clear need for statistical information on the amount of potential cargo, classified by weight, volume and destination. Given this information the obvious problem whether it is worthwhile to make up small parcels into container loads can be approached, by comparing the cost of grouping sub-container parcels, with all that implies, with the savings obtained from containerisation. The problems associated with loading mixed goods into a container, are in no way different from those a haulier experiences in loading his vans, and are, therefore, of second order. There is, however, the additional complication, that shipping companies charge different rates for different types of goods. With a few exceptions, there does not appear to be a tariff for cargo in containers independent of goods type, and this tariff structure may - and to our knowledge in certain cases already does - militate against containerisation of certain types of dry cargo.

3. TRANSIT PROCESS

The various parties concerned at each stage of the passage of a parcel of goods from consignor to consignee are

Shipper
↓
Packer
↓
Cartage - Inland Transport
↓
Forwarding Agent
↓
Docks
↓
Customs
↓
Shipping Co.
↓
Destination Docks
↓
Customs
↓
Clearing Agent
↓
Cartage
↓
Consignee

Not all the above mentioned are necessarily separate. A shipper may pack his own goods, inland transport may be arranged by the shipper or the forwarding agent etc. In the main, however, it is the forwarding and clearing agents who arrange the inland transport, select the shipping company and the ship, offer the goods for customs inspection, are responsible for clearance from the docks and arrange insurance.

In parallel with the transit of the parcel, there is a transit of documents carrying information about that parcel, and in general a parcel cannot move from one stage to the next before the appropriate document is at hand.

We are told that a significant proportion of delays in transit, particularly clearance through customs and from docks are due to delay in information flow.

Whilst in ordinary shipping traffic delays due to lack of documentation is costly, such delays in container traffic could easily counterbalance all the advantages claimed for it.

Thus there is a definite need to investigate the information system and document flow and suggest methods of ensuring that the right information is available at the right place at the proper time.

Numerous EDP studies have shown that in systems, in which a great variety of documents are processed, each type of document carries a large proportion of information also contained on the other documents. In other words the total information content of the entire set of documents is much less,than the variety of documents would lead one to suppose. In such a situation the use of a computer effects a considerable simplification in processing the information and at the same time speeds the information flow, with sufficient savings in processing costs to offset the cost of the computer.

There can be no doubt that a similar situation obtains in the documentation of shipping traffic; there is thus a prima facie case for an EDP study. Whilst, however, until very recently, most EDP studies were concerned with information flow within a single organisation, in shipping the information moves between a number of different organisations some of which may be competitors. Data processing by computer, if found advantageous, would therefore have to be carried out by a separate agency, not connected with any of the parties concerned, but providing a service to all parties, better and at a lesser cost, than they can provide themselves.

Such an agency would also be charged with keeping the confidential nature of the information secure.

There is a precedent for such in inter company information processing agency, handling confidential data, in the recently established Centre-File Limited.

All our investigation has shown that customs clearance of containers in the case where the container holds a single parcel,does not cause delays. In the use of grouped traffic, i.e. where a container holds more than one parcel, customs clearance of containers on dock side will take longer and involve higher costs than clearing the same parcels shipped as open cargo, as the container has to be emptied and reloaded. We shall return to this problem in the section on Inland Transport below.

4. THE CONTAINER

(a) Physical Size - National and International standards

The only agreement so far reached in national or international standards for large containers seems to be the section of 8' x 8' (See appendix A) B.S. 3591 shows five sizes in this section namely, 30',20', 17', 10' and 8' approximately and ISO standard recommendation in addition to these shows 40', 6'6" and 4'9". In addition to these there are a large number of American containers in use of the same section but 35' long. It will be seen that the British standard includes an odd size (17') which appears to be related to the existing overall length regulations for vehicle and semi-trailer of 13 metres, i.e. two 17' containers connected. At present the two larger sizes, 35' and 40' are outside British regulations for road transportation although there is some prospect of the 35' one becoming legal in the near future. The recent National Development Committee for movement of exports has already made a recommendation that the overall vehicle dimension for U.K. should be 15 metres which will agree with the standards used on the Continent.

With regard to corner fitments or hitching points, no specific recommendations are made as to dimensions or type in the B.S.S., and so far only a recommendation has been drafted for ISO. Therefore, there are already at least 8 "standard" size large containers in use at present and devices for lifting these vary from fixed shackles on roofs to special "twist-lock" type corner castings on American-derived designs.

(b) Attachment to Vehicles

There are almost as many different types of attaching fittings to secure the container to a vehicle either road or rail as there are different constructions of container. Some are designed for carriage on special semi-trailers which are a little more than a rigid chassis, and these are provided with special locking device to suit the equipment. Others are designed to fit four projections on the vehicle which can then be secured by rotation of these pegs. More frequently, however, and more particularly with British designed containers, no such built-in securing points are provided for, and they are either lashed or otherwise secured to a flat vehicle, either road or rail.

With every week that passes more and more containers are being put into service although there is, as can be seen, no agreed standard on the important detail of hoisting and securing.

(c) Mobile Lifting and Handling Devices

If container traffic is to make a headway that its protagnoists claim then a standard method of handling them must be devised. At present when a load of containers arrives at a port they may be of any one of the sizes quoted above and may have any kind of hoisting point. The essence of fast container handling will be the standard lifting device and unless this can be used on all containers to be handled, the advantages of rapid turnround will be forfeited. So far no one has devised a top lifting frame for the "twist-lock" type fittings which is capable of accepting rapidly more than one size of container. The development of some gear of this type is an urgent necessity. Some containers have already been designed with fork truck or straddle carrier "pockets" although the majority of them have flat bases without this facility. It would seem likely that normal fork truck operation with any but the smallest type of container will present enormous difficulties both of manoeuvrability and safety, even if fork pockets are provided. Some knowledge of the weight distribution of the loaded cargo will be required to be known before the load is lifted. Side loaders present a better possibility, but here again it seems likely that handling in this way might be limited to empty or lightly loaded containers of the small sizes. American practice so far has been to use straddle carriers for container handling in marshalling areas, including a "Drott" type which is being used by both B.R. and in other places in this country. These machines can either lift containers from the bottom by making use of the pockets provided therein or alternatively, and more commonly, lift by means of the "twist-lock" frame from above. Any such machine must be capable of stacking containers at least two high, in order to conserve space in marshalling areas.

(d) Ship Loading and Unloading

Apart from existing roll-on/roll-off vessels, and one or two drawing-board studies of possible side-door loading ships, all known vessels operating or at present under design or construction for container transport are top-loading. This means that some form of heavy duty lifting device must be provided to remove and load containers from ship to shore. The 40' container has a loading rate of 30 tons, so this must be allowed for when designing such equipment.

Most of the vessels so far described for container traffic require the containers to be stored in vertical "cells" and stacked four or five high per cell. Apart from the limiting effect on ship design, this implies that a given ship will be restricted to one, or at the most two, sizes of container, unless the cells can in some way be made flexible longitudinally. Such cells will call for an accuracy of loading that would be difficult to achieve with a jib crane, and in addition, all attachment for lifting will have to be done from the top of the container.

This points to either an existing design of container crane or special adaption of some form of bridge, gantry or transporter crane, together with specialised lifting frames, as are used in American practice. This in turn means also that any container which will not either fit the cell size or be capable of top attachment, is precluded from the operation. The use of this type of crane will further limit the area in which containers can be positioned for loading to and unloading from the vessel, as compared with a large jib type crane. Therefore, either the transport vehicles must be accurately positioned for each load, or use must be made of some intermediate handling device, such as straddle carriers (see above).

One of the implications of this situation is that many of the existing "non-standard" containers will either have to continue to travel as roll-on/roll-off traffic or deck cargo, or be confined to a specific port or ports.

Once again the need for agreement and standardisation on containers is shown to be a paramount requirement.

The overwhelming majority of ships now in use are, of course, ordinary cargo vessels, and one cannot assume that specialised container ships will quickly take their place.

There are no insuperable difficulties in loading a vessel of orthodox design partly with containers and partly with open cargo. As containers for equal tonnage will take up more cargo space than open cargo, a disadvantage that may be more than balanced by the advantages of containerisation, it should be possible to find a "break-even" point, i.e. an optimal proportion of containers in the total load of a ship. This optimal proportion will alter over time, as containerisation becomes more popular. (See also section 8.)

(e) Ownership

Containers are capital goods. The number of shippers or consignees whose traffic requirements are sufficient to make it economic for them to own containers must be very small indeed, hence containers must be made available to shippers on a hiring basis. In fact this type of leasing service already exists and in the main is run by forwarding agents. Since containers generally can carry a variety of goods, the owner companies face a problem of return loads, similar but somewhat more difficult to that of public carriers. The problem again must be approached from two directions, information processing and operational logic.

5. BENEFITS OF CONTAINERISATION

In the final analysis it is the shipper or the consignee or both, who have to pay the total cost of sending a parcel from origin to destination. They are not interested in what way that parcel is transported as long as it safely arrives in good time. Speed of transit itself is not of primary importance. They are the consumers of a transport service and to induce them to change their taste, e.g. accept containerisation, some of the savings claimed as due to containerisation must be passed on to them in the form of lower charges.

Also, increased speed of transit is a secondary effect of containerisation, which will be of advantage to the shipper only if the proportion of containerised traffic is high enough to bring down the average transit time on any given journey sufficiently to influence his production or assembly schedule.

6. PACKAGING

It is claimed that parcels in containers need less packaging than otherwise. This is certainly true for certain types of goods, such as boxes, in particular where a single parcel constitutes a container load. Any saving in cost of packaging would directly accrue to the shipper. There is, however, a lack of information as to the packaging requirements for various types of goods when shipped in containers, as single parcels and as grouped traffic.

It is therefore, impossible to measure such savings. It is not at all clear from where this information can be obtained, though it appears that forwarding agents may be the most likely source.

7. PROTECTION AGAINST PILFERAGE

Better protection against pilferage, though seemingly a direct advantage to shipper and/or consignee, effects them only indirectly, as part of the insurance premium - the total of which is itself a part of the total cost of transferring a parcel from shipper to consignee - protects them against loss by pilferage. Hence the direct gain accrues to the insurers. We do not know whether any actuarial research on this particular subject has been done or is in hand. From the economic point of view, if containers offered better protection against pilferage, it is in the interest of the insurance companies to stimulate container traffic and the only economic way of doing so is by offering to users part of the gain in the form of lower premiums.

8. TURN-ROUND OF VESSELS

The prime claim of containerisation is that it will speed up the turn round of cargo vessels.

It is obvious that, if indeed a parcel of dry cargo exported from or landed in this country is on average two tons and a container holds on average sixteen tons, loading and unloading of ships can be greatly speeded up by containerisation. A significant part of the total cost of running a ship is due to time spent in port (including time spent outside harbour waiting for a vacant berth). The potential saving due to speedier turn-round of ships is of direct advantage to the shipping company. It is, however, not directly computable from the simple statement above, from which it appears that time in berth could be reduced by an average factor of 8, if all cargo were containerised.

In the first place, shipping companies usually gain their traffic by advertising certain dates during which a given ship will accept cargo for given destinations at a stated port. Unless the amount of cargo offered at the dock side is sufficient to fill the ship in a period less than that advertised, the ship will stay in port till the closing date. The advantage of speedier loading, due to part of the cargo offered being containerised, may thus be lost completely,

Secondly, ordinary cargo ships are not the ideal type of vessel to carry containers. Loading such a ship in part or wholly with containers results in loss of available cargo space. Thus there appear to be no advantages to the shipping company in accepting containerised cargo, unless the advantage of speedier loading and unloading can be made to affect the turn-round time in port. If this can be done, the loss of cargo space due to containers must also be outweighed by the increased number of journeys a ship can make due to speedier turn round. There is then the further effect that the potential of an increased number of journeys may not be open to profitable exploitation unless the total amount of cargo available also increased, or unless the total amount of traffic can be transported in a smaller number of ships.

The effects of the higher loading speeds of containerised cargo have thus to be traced through a complex of interrelationships, basic data for which can only be supplied by the shipping companies and may be of a highly confidential nature. For an overall solution to the problem of what is the proportion of containerisable cargo that optimally should be containerised during, say, the next 10 years, requires an econometric and O.R. study taking account of these interrelationships as well as the effects of container traffic on ports and inland transport.

But apart from this study it is clear that speedier turn-round of vessels carrying mixed (i.e. container and open) cargo cannot be realised, unless the present method of assigning cargo to ships, by advertised acceptance periods, is materially altered. The precondition of such a revolutionary alteration is that information about all available cargo in both forms, containerised and open, is at hand sooner than is the case at present. This would require a clearing house of information about traffic. Such a clearing house is entirely possible, given modern data processing equipment. As in the case of documentation mentioned above, the information processed is of a highly confidential nature, the service concerns a number of competing interests, so that the clearing house agency must have the status of a professional service. In fact, what is probably needed is a centralised information processing and documentation service that acts as an independent public service to shippers, forwarding agents, land and sea carriers, and which is constrained by law to safeguard the confidence of its users.

Despite much talk about specially designed shipping and future construction the present position is that the only container vessels at present plying are either American or Scandinavian, the latter a very recent addition.

Various estimates have been made on suitable sizes for container ships in terms of units of containers (although not many forecasts have been made of what this Unit size should be, except in the case of B.R.) ranging from 200 to 2,000 containers per vessel. The great advantage to any shipping line on the use of containers is the reduction of time spent in Port and there is obviously a relationship between the size of vessel, the length of the journey and the time it will take to unload the containers. A good average handling time to load or unload a container is 3 - 4 minutes per unit and therefore it will be seen that to unload a vessel of 2,000 unit capacity might involve a continuous unloading operation of 133 hours or 5½ days working continuously, if only one crane per vessel is employed. Even if this was reduced to 3 minutes per container and the average number per vessel was 600 this still demands a continuous unloading time of 30 hours, whereas the stated advantages of container ship operation are usually given that the vessel will not remain in Port for more than two tides. It is therefore evident that for very short journey times, i.e. cross-channel traffic, the economic breakdown in terms of time is likely to be less than 800 containers per vessel and may be as low as 200.

Some of the present roll-on/roll-off vessels can carry up to 40 containers on trailers per journey and an additional 20 or so as deck cargo with a minimum turn-round time of four hours or less. With the larger vessels too, the problem of berth facilities will arise and also the question of access to these either by deep water channels or by locks. This latter in turn will limit the turn round time still further, particularly if negotiation of crowded esturial waters must be taken into account.

9. DOCK CONGESTION

Causes of congestion at docks are various. From our enquiries we found that delays in clearing parcels due to non-arrival of the necessary documents is one of the major ones. Others are tardiness on the part of the consignee or clearing agents in fetching their consignments, lack of space which restricts movement and hence increases loading time for a given parcel, arrival of goods well in advance of the opening date for the vessel, and so on. Congestion due to parcels lying at dock side longer than need be, is not necessarily an economic disadvantage to the dock operator, as rent/demurrage is charged on a time basis.

Further, congestion due to delay in clearing or early arrival of cargo cannot be influenced by containerisation except in so far as containers can be stacked, and therefore containerised parcels may take up less space than the same amount of goods as open parcels.

In total it appears that easing congestion in docks is a secondary effect, and depends entirely on how well the other parties concerned will exploit the advantages offered by containerisation.

Whilst a number of Port Authorities have announced their intention of constructing international container berths in the near future the present position is that at only one port (Felixstowe) is there a crane of sufficient capacity and versatility to handle all types of existing container traffic. A temporary measure has been taken at Tilbury where a derrick crane capable of about 30 tons is in operation but its uses are limited. Most container traffic at present from U.K. to the continent travels as trailers or semi-trailers on roll-on/roll-off vessels with some independent containers travelling either in the vehicle deck or as top deck cargo. If we regard this as container traffic, then it is possible to say that many more Ports are handling this at present such as, Immingham, Felixstowe, Harwich, Tilbury, Newhaven, Dover, Southampton, etc. However, with the advent of container ships only those Ports equipped with proper handling devices for modern containers may find it profitable or possible to handle this traffic.

It is apparent that if facilities are going to be made available at ports to load and unload container vessels, then this must include some specialised lifting gear in the form of gantry or other cranes adapted or designed for this kind of work. Even allowing for these fast conditions of operation, it is unlikely that the average handling time per container will be much less than three minutes and that more than one crane or at the most two could operate on a single vessel.

As will be seen from the paragraph on shipping a little simple arithmetic will give a good idea of the volume to be handled, the rates of handling and the areas required at the port. Even if containers are placed closely i.e. allowing 1' clearance, approximately 150 30' containers will cover an area of one acre. We have already seen that the minimum unloading time is three minutes per container and unless this is placed on an already waiting vehicle it must be moved from the vicinity of the crane immediately. If we assume that a straddle carrier is capable of an average speed of three miles per hour, then the journey which can be completed between container drops is limited to approximately 180 yards, allowing one minute for pick up, put down, and manoeuvring. It is apparent, therefore that even with one unloading device and no waiting transport, at least two straddle carriers or similar devices would be needed for full operation.

The ideal situation would be to move the containers by rail or road transport immediately on discharge from the vessel. Failure to carry out this procedure will refute one of the first principles of handling - i.e. do not put down what you intend to pick up again almost immediately. If we accept this immediate loading to vehicles and postulate a vessel containing some 6 - 800 containers the amount of transport both road or rail that will be required can be readily seen. If it is necessary, however, to place these in a marshalling area it is likely that a density of 92 *to the acre would be as much as could be tolerated to allow for ease of handling and this also gives an indication of the area required adjacent to the berth. The movement of this

* See Appendix B

amount of traffic in a short space of time obviously calls for very great organisation of transport and it seems quite unlikely that any customs or groupage facilities would be possible at the berthside. The implication of this, of course, is that the containers should proceed as quickly as possible to large inland depots for customs inspection, unloading or sorting.

From the foregoing it is apparent that if container traffic is to become a major part of the general cargo handling facilities available in this country then only a limited number of ports are going to have sufficient free space and transport capacity to accommodate it. Such development cannot take place over-night and some of the forecasts of short term change-overs of cargo patterns are obviously purely speculative.

10. INLAND TRANSPORT

If we assume a high volume of traffic being handled in containers, as stated above, it is unlikely that adequate facilities could be provided at ports to carry out customs checks and sorting procedure. This has been recognised by several of the new container consortia but it is doubtful whether anyone has considered in detail the total amount of space and facilities that would be required.

When container traffic begins to reach the proportion envisaged by some of the more optimistic prophets, i.e. up to one quarter of the total seaborne traffic handled, we shall be faced with a truly monumental transportation problem.

When a single parcel constitutes a container load, there is a definite reduction in total handling effort by sending it in a container. Once the container is loaded (or vanned, a new term now coming into use specifically for loading containers), the goods themselves will not be touched, and the container need not be opened, except for possible customs inspection, until it arrives at the consignee. Notionally the container could be put on a lorry at the shipper, brought straight to the docks, lifted from lorry to ship, and similarly at the end of the sea voyage lifted from ship on to a lorry and brought to the consignee. The vehicles used could on their return journey pick up other containers, and thus a seemingly perfect state of full exploitation of transport facilities could be achieved.

Even if containerisation were restricted to single parcel loads, inland transport by road vehicle could have disadvantages once the total amount of containerised cargo is such, that vehicles carrying containers become a significant proportion of all vehicles, on the road; in the congested conditions of our roads additional large vehicles can increase the frequency of traffic congestion proportionately more than the numerical increase, and this would be particularly so in the approach roads to ports and in the port area itself, and may in fact increase dock congestion.

Trains seem a more suitable means of long distance inland transport of containers, particularly if ships can load and unload directly from or to trains. British Railways have, now started to run such container trains, but at present their overseas facilities are restricted to the short continental service from Harwich.

Container trains, of course, require suitable sited inland depots.

Such inland depots become an absolute necessity in the case of grouped traffic, independently of means of inland transport.

The operation of such depots would be similar to that of depots run by public carriers for small parcel traffic, but for efficient operation the owners would have to be a subscriber to the traffic information clearing house.

The above implies the existence of very large inland depots where containers will arrive direct from the ports, sealed and in customs bond. Even a quick glance at the rough estimates of load and unloading times in section (8p9) of this report will indicate that four 600 unit container vessels being unloaded simultaneously would present a depot with 2400 containers within 48 hours, and, of course, a similar number would be required for despatch. Even the prospect of 5,000 containers handled per week in one depot is somewhat daunting, and it is quite certain that to cope with this kind of flow a high degree of efficiency in internal physical handling will be required.

It is manifestly impossible that quantities at this level could be handled purely by road transport to and from a single depot, and there seems no question that the large majority must travel to and from the ports by rail. This means that sufficient railhead capacity must be provided for at least 1,000 containers carrying vehicles at any one time, with facilities for unloading or transhipping approximately 50 per hour.

Some of the transhipment would be to road vehicles for direct delivery, but much would be required to be unpacked for sorting groupage traffic.

Assuming that it was possible to transport even half the quantities of containers given above by road transport, then marshalling facilities would be required for about 500 containers at any one time, and on occasions possibly twice that number.

Taking the 30' container as the standard future size, it is doubtful if more than 68* could be accommodated per acre (without trailers) unless they were stacked two-high, when the density might rise to 136*per acre. This indicates for a depot of the size postulated, an area of something like 20-30 acres would be required and that it certainly would not be possible to site this in a densely populated urban area, even if such a large site could be found.

Although such a large depot seems unlikely, we must remember that these depots will be replacing the present areas in and around docks, of which a vast amount is unused at any one time even at present. Such land might in time become available for urban development and the use of crowded inland and esturial dock areas begin to fall away, leaving the deep berth and easily accessible port areas to handle the container traffic.

The number of such depots required for all types of container traffic and their siting throughout the U.K. would form a distinct but connected part of the study on what part of the total available cargo should ultimately be containerised. The question of ownership of such depots is another problem. Obviously the operation of a depot must show a profit, and that part of the total cost of sending a parcel that is due to it going via a depot, must be counterbalanced by the savings due to containerisation.

There seems little doubt that one of the major developments in the container field will come from efficient groupage traffic, eliminating port handling of small lot cargoes and requiring inland packing, unpacking and sorting centres.

It seems already certain that savings due to containerisation, at least as far as grouped traffic is concerned, will be realised only after the quantity of container traffic exceeds a certain threshold. This threshold quantity,however, will probably only be reached, if all parties concerned, even though they do compete amongst themselves, act in a way, that stimulates the use of containers by shippers generally. For this reason ownership of a depot by, for example, a Shipping Co. may delay the reaching of the required threshold. Again, ownership of depots linked to any of the existing competing interests may result in a number of depots in excess of the optimum, and though this in itself would not

* See Appendix B

at first hinder the progress of containerisation, it may after a certain advanced stage of containerisation has been reached, make depot operation unprofitable and hold up further progress.

Grouped container traffic will require that customs examination be carried out at the depot. At present a container with grouped parcels, arriving in the U.K. is inspected by customs at the dock side. This usually means unloading and reloading the container. At the depot the container is in any case unloaded. Much of the advantage of containerising grouped traffic would be lost, were the authorities to refuse the status of a bonded warehouse to inland depots.

11. A COORDINATED APPROACH TO CONTAINER OPERATION

From what has been said in the preceding sections a general way of approaching the problems of containerisation becomes apparent.

The problem itself can be defined as:

1). What are the measurable economic advantages of containerisation?

2). What are the operating conditions that will exploit such advantages, as can be shown to exist, in an optimal way?

It is also apparent that research into particular aspects of the problem such as, for example, depot location, how best to use ordinary cargo vessels, etc., cannot be considered in isolation, even though solutions to these particular sub-problems are necessary. Further, experts in at least four different fields will be required to co-operate in the research, namely in econometrics, operational research, data processing and industrial engineering, and the research team must consist of personnel not connected with any of the parties and firms now engaged in container traffic. They will also have to be given access to confidential commercial information.

There is now a trend towards containerisation which appears to gather strength increasingly. It is our opinion, that this could lead to a similar situation as was, and still is, experienced with computerisation. Computers, like containers, are a good thing, but their real advantages were not properly brought out, with the result, that even in the U.S.A a large number of users, were disappointed. That situation, now after a long period of trial and error, seems to righten itself, and the number of firms earning a worthwhile return from the use of computers is steadily increasing.

No doubt a long period of trial and error in containerisation, will ultimately result in the economic use of containers. The question is, can we really afford a period of trial and error?

APPENDIX A

The table below shows container sizes for both B.S. 3951 and ISO standards

B.S. 3951 - Standard freight containers - Dimensions

Designation	Height (ft)	Height (in)	Width (ft)	Width (in)	Length (ft)	Length (in)
A	8	$0^{+0}_{-3/16}$	8	$0^{+0}_{-3/16}$	29	$11^{+0}_{-3/8}$
B	8	$0^{+0}_{-3/16}$	8	$0^{+0}_{-3/16}$	19	$10\frac{1}{2}{}^{+0}_{-1/4}$
C	8	$0^{+0}_{-3/16}$	8	$0^{+0}_{-3/16}$	17	$0^{+0}_{-3/16}$
D	8	$0^{+0}_{-3/16}$	8	$0^{+0}_{-3/16}$	9	$9\frac{3}{4}{}^{+0}_{-3/16}$
E	6	$10\frac{1}{2}{}^{+3/16}_{-0}$	6	$10\frac{1}{2}{}^{+3/16}_{-0}$	7	$10\frac{1}{2}{}^{+0}_{-3/16}$

Recommended Iso standards from draft Iso Recommendation No. 80[illegible]

Designation	Height (ft)	Height (in)	Width (ft)	Width (in)	Length (ft)	Length (in)
1A	8	$0^{+0}_{-3/16}$	8	$0^{+0}_{-3/16}$	40	$0^{+0}_{-3/8}$
1B	8	$0^{+0}_{-3/16}$	8	$0^{+0}_{-3/16}$	29	$11\frac{1}{4}{}^{+0}_{-3/8}$
1C	8	$0^{+0}_{-3/16}$	8	$0^{+0}_{-3/16}$	19	$10\frac{1}{2}{}^{+0}_{-1/4}$
1D	8	$0^{+0}_{-3/16}$	8	$0^{+0}_{-3/16}$	9	$9\frac{3}{4}{}^{+0}_{-3/16}$
1E	8	$0^{+0}_{-3/16}$	8	$0^{+0}_{-3/16}$	6	$5\frac{1}{2}{}^{+0}_{-3/16}$
1F	8	$0^{+0}_{-3/16}$	8	$0^{+0}_{-3/16}$	4	$9\frac{1}{2}{}^{+0}_{-1/8}$
2A	6	$10\frac{1}{2}{}^{+3/16}_{-0}$	7	$6\frac{1}{2}{}^{+3/16}_{-0}$	9	$7^{+0}_{-3/16}$
2B	6	$10\frac{1}{2}{}^{+3/16}_{-0}$	6	$10\frac{1}{2}{}^{+3/16}_{-0}$	7	$10\frac{1}{2}{}^{+0}_{-3/16}$
2C	6	$10\frac{1}{2}{}^{+3/16}_{-0}$	7	$6\frac{1}{2}{}^{+3/16}_{-0}$	4	$9^{+1/16}_{-1/8}$

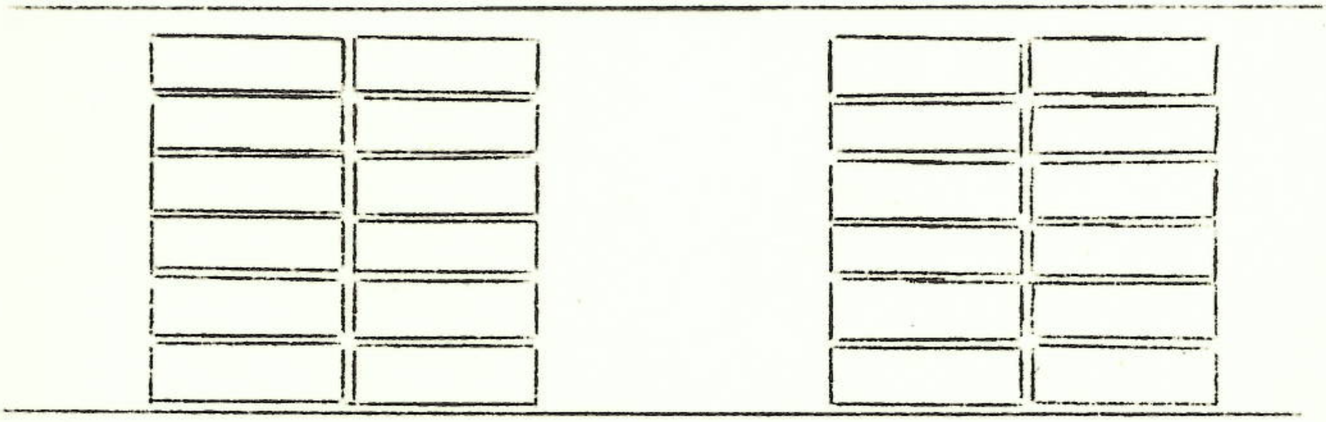
APPENDIX B

Marshalling and Storage Areas required for 30' x 8' x 8' containers

1. Containers on Road Trailers

Marshalling Pattern: Rows of two, back to back, with one foot clearance minimum between adjacent containers. Gangways 45' wide to allow withdrawal and turn.

Total number of containers per acre: 92
Space occupied by containers as percentage of total area: 50% approx.



2. Containers at Ground level, no trailers

Marshalling Pattern: Rows of 4 in line minimum clearance between adjacent ends one foot, clearance between rows to allow access by straddle carrier 7 feet. 45 ft gangways every 4 rows to allow withdrawal.

Total number of containers per acre (68 (one high)
(136 (two high)

Space occupied by containers as percentage of total area: 40%