CoA Memo. No. 144

THE COLLEGE OF AERONAUTICS

CRANFIELD

MATERIALS HANDLING RESEARCH UNIT.

Second report on containers

by

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January, 1968

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1. INTRODUCTION

In our first report on containers published in January, 1967, we tried to summarise progress in this new mode of transportation and to define some of the problems which existed.

Although during the past year much progress has taken place in the development of container traffic to and from the U.K., very little has been published about the possible solutions to such problems as overall documentation, marshalling of containers at ports and terminals, and the congestion caused to road and rail systems by the injection of large numbers of containers.

During the past 12 months, bids have been made by a number of ports for a share of the expected container traffic, notably, Tilbury, Greenock, Grangemouth, Liverpool, Bristol and Southampton. All of these are old established ports with congested dock areas and it is difficult to see how some of them can cope with a large flow of containers. Nevertheless, some port authorities are busy ordering cranes and dock facilities without having any firm ideas where their trade is to come from.

With the ever increasing cost of U.K. port facilities to shippers and the inflexible labour attitudes of the British dock workers, it is apparent that competition for container traffic is likely to be sharper between continental ports and U.K. ports, rather than between individual ports in Britain. The possible economic consequences of this situation when container traffic reaches a high proportion of cargo shipping must be borne in mind. This argument, of course, does not take into account those smaller British ports which have set themselves out to develop container traffic as their main function, i.e. Felixstowe, Immingham and, to some extent under B.R. control, Harwich.

There seems little doubt that Tilbury will endeavour to take a large share of the long distance container traffic particularly to Australia and the Far East since several consortia and the P.L.A. have sunk large sums of money in an attempt to ensure this. Whether they will succeed depends very much on the quality of the competition.

The question then arises, can we afford such a multiplicity of container facilities nationally, and more important, can the increasing traffic be expected to pay for them? That this is a matter for central direction outside the circus of party politics cannot be denied.

The other possible avenue of development for container traffic is the expansion of very large west European continental ports to accept a major part of the North Atlantic and Australasian container trade, with "feeder" services to the U.K., either in smaller fast container vessels or on road trailers as RO/RO traffic.

Container ships currently under construction or design for Atlantic or deep sea routes are of high capacity (more than 800 containers) and high speed. They will rely on fast turn round for their economic advantages to be fully realised, and this will only be possible in a port with proper facilities.

The old principle of having a ship with cargoes for a number of different ports carrying out a "milk round" delivery may have to be abandoned with containers. Loading and unloading will be carried out (probably simultaneously) in a port with sufficiently sophisticated equipment and marshalling facilities to make turn round of the vessel possible in the minimum time, which means continuous shift working by the port labour force. The proportion of cargo for minor destinations may then be despatched by road, rail or feeder sea routes to their final destinations.

It is at this scale of operations where the decision to use U.K. or Continental ports will be taken by shipping companies, and this in turn will probably depend on the proportion of trade in containers for each area served. If the total North American container traffic is greater for West Europe (Germany, Netherlands, Belgium, France and perhaps Switzerland and Italy) than it is for the U.K., there is little doubt that the unloading port will be on the European mainland. Further factors in favour of this solution will obviously be those of lower berthing costs and a more flexible approach by dock labour.

It was with these thoughts in mind that the Research Unit decided to undertake a visit to the Netherlands and Belgium to see what impact the "container revolution" was having in those countries, which contain several of West Europe's largest and most modern ports.

American attitudes and facilities regarding containers have been public property for some years, and it is fairly easy to piece together the British view, but very little has been published about continental thoughts and facilities on containers, and in view of the possible increases in the volume of traffic it seemed necessary to find out more clearly what was being done.

2. Preliminary Remarks.

Contacts were made with a dozen or more organisations in Holland and Belgium who had interests in the container traffic. These included Port Authorities, Shipping Companies, dock operating companies, container terminals and stevedoring firms, besides the equivalent of the Road Haulage Association. In every case we were welcomed with interest, and were given full answers to all our questions, and had many uninhibited discussions with the various executives.

In many cases, considerable interest was expressed in our previous report, and it was apparent that it had been read in great detail by many people, and not only those we talked to. Nowhere did we find any disagreement with our comments, and in one case, a chief executive said that the report had actually strengthened their case over a board decision.

This is in contrast to our efforts in the U.K., where we had great difficulty in persuading any organisation in the container business to even discuss the subject with us, and we have had little feed back from our first report.

3. Attitudes to Container Traffic

Whilst the increase in container traffic was universally appreciated, it was nevertheless possible to discern a

difference of emphasis towards the future between the Dutch and the Belgians.

The general attitude in Holland towards the future of container traffic seemed to be the acceptance of the inevitability of growth, but the hope that such growth would follow a definite pattern. This pattern was seen as a steady increase in the number of containers and vessels handled, but more on the lines of American development than as a separate concept. The handling equipment was designed for 20' and 40' containers with ISO corner fittings, and in most cases no provision was being made to accept other sizes, notably 30'. Indeed, the hope was expressed that these two sizes (20' and 40') would be the only ones in common use, with the 40' constituting an increasing proportion.

The Belgian attitude on the other hand appeared to be more flexible. They welcomed the advent of container traffic, and were quick to see the advantages of offering facilities for every kind of container and vessel. Handling equipment was generally more flexible, and had been specifically designed to high standards for their own needs. A feature of Belgian crane design was that the spreader beams had been purposely designed for rapid adjustment to fit any size of container between 20' and 40'. Antwerp, for example, saw themselves as the leading future container port in Europe, and this entrepreneur spirit was reflected by most people we spoke to there.

In the following sections, an attempt is made to look at the Continental approach to the various subjects. Where no distinction is drawn between the Dutch and Belgian views, it can be taken that the remarks express a common viewpoint.

4. Cargoes.

In general, views differed little from those held in U.K. on the suitability of containers for dry cargo, although one Belgian shipping firm said that they foresaw a possible use of containers for handling certain bulk materials, particularly on dual-purpose vessels, where other mixed cargo might be travelling 'loose'.

Much the same consideration seemed to apply to general dry cargo as in U.K.: the average lot size was small, and if container traffic became universal, groupage was inevitable.

5. Groupage and refrigerated traffic.

In both countries, with their relatively small areas and narrowness in relation to the coast line, it was felt that little purpose would be achieved in having internal groupage depots. It was felt that what groupage there would be in the foreseeable future in both countries could well be handled in dockside groupage depots adjacent to the container terminals, and this policy was being followed in both countries.

In no case was the terminal operator or stevedoring company anxious to carry out the groupage themselves, and it seemed likely that consortia formed by a number of forwarding agents in each port would operate this service. On the continent, as in Britain, forwarding agents are finding themselves in a difficult situation in regard to container traffic, and such groupage consortia might well be a solution.

So far, only a very small proportion of traffic was accounted for by groupage, and the increase was seen as dependent on the development of traffic generally.

Refrigerated traffic formed only a very small proportion of the current flow, much less than one per cent in most cases. Provision was made at terminals and docks for either motor-driven generator trailers or plug-in points for power takeoff from public supplies. One difficulty stated here was that such equipment was expensive to instal due to the lack of standardisation in electric supplies to refrigerator units. Provision had to be made for 440v 3ph., 220v 3ph.,., 240v 1ph., 110v 1ph.,.. at both 50 and 60 c/s frequency standards, with possibly 110v or 120v D.C. as well.

6. Containers (a) General

All containers operated in the ports we visited were either

owned by a shipping line, or were "foreign-owned" (i.e. American or U.K.). As far as we could ascertain, there are no independent container operators or owners in Holland or Belgium, apart from those owned privately by very large firms such as Philips: this means among other things, that transport companies regard container traffic in a very different light to their counterparts in U.K. or U.S.A. Most container terminals provide trailers for road travel, so that the transport operator has only to provide an articulated vehicle traction unit. The business thus tends to go to smaller operators, who have frequently been accused of undercutting each others' rates, to such an extent that the larger transport firms claim that container traffic is uneconomic, and are unwilling to compete for the business.

This has its repercussions on the responsibility for damage to the container itself, making it very difficult to pin down specific damage to a place or person. One shipping line claims to have overcome this to a large extent, by developing an inspection document, which is required to be signed by the drivers at any changeover point, certifying that the container was in good condition or otherwise, and the driver taking over then signs his acceptance. This was said not only to have pinpointed areas of damage, but actually reduced it.

(b) Physical Size, National & International Standards.

Satisfaction was expressed all round at the attempt to introduce ISO standard containers universally, although there was some apprehension about the recent American lobbying to get the 35' size and 8' x 8'6" section incorporated into the ISO standard.

The Dutch were quite firmly of the view that future development of the traffic should be in the 20' and 40' sizes, and showed little interest in the 30' size which is quite common in Britain. Some of the reasons given for this were that two 20' could be coupled to travel as a 40 ft. whereas two 30 ft. were too big to be coupled, but too small as an individual load. Also the common vehicle-plus-trailer seen so commonly on Continental roads could handle two 20' as load and trailer but not two 30'. A further reason was,

of course, the fact that most Dutch spreader-beams were only designed for 20 or 40 ft containers, and were not intermedialy adjustable.

On the other hand, the Belgian viewpoint seemed to be that whilst most present traffic (largely American in origin) was in 20' and 40' sizes, there would undoubtedly be a need to cater for other lengths and sections as the traffic developed. Most Belgian crane equipment had been designed with adjustable spreaders in anticipation of such developments, and we were told no restrictions would be placed on any container traffic. The 30' container was regarded as more likely to be a railborne load than trailerborne, and was not thus seen as a problem.

(c) Attachment to vehicles

All container terminals or shipping lines which we saw had provided road trailers for the movement of containers, and these were of course designed for the purpose. Where contract hire vehicles were used, the containers were lashed or otherwise secured to the vehicle trailer.

No specialised rail vehicles were either provided or evisaged by Dutch and Belgian railways, all rail borne containers being carried on normal flat cars. This was not seen as a difficulty, since there were no long hauls inside either Holland or Belgium, and the limited speeds imposed by these flat cars was not regarded as important. For containers travelling further afield, notably Germany or Switzerland, it was stated that special vehicles were being developed by the German Railways, in conjunction with the fast TERRE trains now starting. Belgian railways hoped to come to an agreement about this traffic, but it was not mentioned specifically in Holland. The use of flat cars, of course, prevents carriage of 8' x 8'6" section containers by rail, as their loading gauge is limited in Holland and Belgium as in U.K.

(d) Mobile lifting and handling devices.

In most places in both countries, marshalling areas and

quaysides are paved with 2 x 2 m steel-edged concrete squares,(See figs. 1 and 2) which were said to be easy to lay and maintain, and provided the subsoil was satisfactory, strong enough to stand even the point loadings of large handling vehicles. In Rotterdam, however, due to the characteristics of the subsoil, it had been found impossible without extensive soil treatment and concrete to make use of mobile cranes or straddle carriers etc. In this case, a large number of trailers were maintained, only a third of which were designed for travel on public roads, the remainder acting as mobile storage units. It was maintained that the cost of these, plus the necessary tugs, was still considerably less than the cost of soil treatment plus other handling equipment, and apart from taking up a greater area, was just as flexible.

At all other places, mobile cranes were in use, rather similar to those used by B.R. for road/rail transfer, but most of German manufacture.

One Belgian firm had manufactured locally a special device for picking up and moving containers parked at ground level, which was designed for operation either on the terminal or the surrounding dock area.

The general view was that when traffic increases, use would have to be made of sideloaders or straddle carriers, though one firm maintained that small containers could be handled just as easily and quickly by large fork lift trucks.

7. Ship Loading and unloading

Both the method and equipment varied with the port or terminal.

In Amsterdam, for instance, although a crane is to be erected in 1968, present container traffic is entirely by means of American vessels fitted with ship-board cranes. There is as yet no other means available.

At Rotterdam there were both American and German cranes and at Antwerp there were both ordinary dock cranes on

one berth and a large specially designed Belgian container crane at another. The first two are probably well known, but the last mentioned may well serve as a design for the 'second-generation' of container cranes. (See Fig. 3.) It has a boom which extended 35 m (110 ft) either side of the superstructure, and can both load a lighter or barge on the seaward side of the vessel being unloaded, and stack containers in a parking area on the quay. It has an adjustable spreader for 20' to 40' or any intermediate size, and is able to rotate its load 360° from the crab. It is as fast in operation as any of the present generation cranes, with a number of other refinements and a total lift capacity of 35-40 tons.

Another special purpose designed crane for unloading ships will shortly be erected at Zeebrugge, which is one of the continental ports for the B.R. Container Service. This machine will span four rail tracks, with sufficient road space to place loads on road vehicles, and have direct control over rail vehicle movement from the crane cab, thus fulfilling the obvious future problem of rapid transit of large numbers of containers by rail.

Perhaps the most outstanding difference between the attitudes to container traffic in the U.K. and Belgium are the Belgian's approach to container handling and port operation. In the design of handling equipment for their respective container docks both the operating companies in Antwerp and SdFB did not choose among the available equipment but specified what they considered the right performance, and had cranes and other equipment designed to achieve it. One result is the outstanding crane described above for Antwerp, the other is the crane and automatic wagon shunting layout of the Zeebrugge dock. Admittedly the latter dock is designed to accept only a restricted type of traffic (Rail U.K. - Europe) but the philosophy that lead to the specifications of the operating equipment and layout is, in our opinion, generally valid. Automation in container handling has there reached the practicable peak.

8. Packaging

As containers were mainly shipping company owned, there was little attempt to tell the customer how to pack the container.

One shipping line said that customers actively discouraged such help. With regard to groupage traffic, this was mostly to be carried out at terminals under control of forwarding agents and here the necessary skill was directly available.

9. Inland Transport

As stated earlier, both in Holland and Belgium the view was held that in such small countries, distribution and collection of internal container traffic should be carried out by road transport. For containers travelling farther afield present traffic was travelling mostly by road, but with increasing traffic and extended delivery runs it was generally held that rail transport would be more satisfactory. Belgian and German railways are co-operating in order to examine the future of container traffic. The Belgians appeared to be more rail conscious and had better track layouts at docks and even marshalling yards in close proximity, whilst a rail link to Dutch container terminals appeared to have been a secondary consideration, and in one case comprised only two tracks at a right-angle to the berth.

Some apprehension was felt generally that the German railways might attempt to run a heavily subsidised container train service from Bremerhaven to the Ruhr and other parts of Europe, in order to attract shipping to that port. This might mean that the shorter journey from Rotterdam or Antwerp would no longer be so economically attractive and thus trade might be siphoned off from these ports.

10. Shipping and Ship Design

Very few persons in the countries visited were prepared to pin their faith for the immediate future on 'pure' container ships. Most said that they would prefer to useconversions or build dual purpose vessels for at least the next five years. This is probably as much due to the pattern of trade of the shipping lines as to an over-cautious approach. In any case, so many container vessels have now been put into construction that it seems likely there will be adequate if not over-capacity on certain routes in the near future.

One Belgian shipping line, however, put forward the view that the ship of the future would be one capable of carrying both containers and loose cargo, in proportion defined by the break-even point of handling both types, e.g. a containership will carry in addition to containers, sufficient loose cargo to exploit its full capacity, but at the same time the amount of loose cargo will not exceed a limit above which its loading/unloading time would exceed that of the containerised cargo.

11. Marshalling of Containers at Terminals

With the present low throughput of containers, marshalling for loading and unloading was not seen as a problem. One terminal used a type of Production Control board as an analogue device to show the positions of all containers held, showing incoming and outgoing, full and empties by means of colour codes. The physical position of the container was simulated on the board by a small piece of cardboard, bearing the serial number of the container. The entry and exit to all container parks we saw were guarded, and the drivers required to check in or out before being passed through.

The problems of marshalling for loading and unloading vessels were appreciated in depth, but no work appeared to have been done on examining a typical situation, other than purely empirically. Some scepticism was expressed about load and unload times which have been bandied about in U.K. and U.S.A. and the impression was received that when more practical data was available, everyone would be in a better position to make an assessment of what was possible.

12. Customs

As in U.K., customs regulations and officials were not regarded as involving any special problems or difficulties. The Common Market had reduced many customs barriers on the continent, and the examination of groupage traffic would be done at the terminals where it was packed.

One difficulty which was mentioned as possibly hindering the development of traffic was the regulation, that if a

container travels loaded to an inland destination where it is unloaded, it must return either unloaded, or with a part or full load to the same port. It cannot be partly loaded, and then travel to a second point internally for further loading, before returning to port.

13. Specific Project Details

Whilst the main part of this report attempts to reflect our general findings, certain aspects of the Continental approach to container handling were so markedly different from U.K. practice that we felt they were worthy of more detailed treatment.

(a) Overall development of Container Handling Facilities

In both countries, no attempt had been made to impose a container handling dock or terminal on or in an already developed area. Using in most cases reclaimed land, a technique well understood and widely practiced in the Low Countries, specific areas have been ear-marked for container traffic. In most cases a further area for the future expansion of facilities, particularly container parks, had been allocated. A general figure of 100 containers per hectare (2.471 acres) is used for calculation, which seems generous by any standard. It is important to remember that these circumstances attend development in both Holland and Belgium although different means are used to achieve them. In Antwerp for example a dock 350 x 2400 metres (Churchill dock) has been specifically earkmarked for the development of container traffic, and this is directly adjacent to a marshalling yard and the terminal for the TERNE (Trans Europe Rail Road Express) trains which unite Antwerp directly with the rest of Europe and as far as Italy. Additionally a feeder road is being built from the dock to the inter-European highways, E.3. and E.10, 2 miles away.

(b) The Municipal Port of Antwerp

The provision of facilities (dock and quays) at Antwerp are the responsibility of the Municipality which then leases

adjacent areas of land and quayside to specific operating or manufacturing companies. The leases are, however, conditional upon agreed specifications for dockside equipment, such as cranage, buildings etc., being accepted by the lessees, and the municipality will also advance loans for such equipment. Thus, all operators sharing a quay will agree to use a specified type of crane, and any operator must offer at agreed charges his equipment to the others, when he has spare capacity and the others need it.

Six container cranes are envisaged for the Churchill dock: one is already in operation, number 2 is nearly completed and number 3 is being manufactured.

This pattern of a Port Authority's investment has beneficial effects on port operation: co-operation between operators; standardised, compatible equipment, enabling participating firms to exploit their market without crippling their own investment capital. It could, however, not be carried through successfully unless both port owners and operating companies believed that by providing excellent facilities and enthusiastic selling they can attract the necessary trade. There is no doubt that in Antwerp this belief is held by all concerned.

(c) Zeebrugge Container Berth (See Fig. 4.)

As mentioned elsewhere in our report, Zeebrugge is one of the continental terminals for the BR container service from Harwich, and a special container berth has been designed to handle this and similar traffic. Since it is expected that the majority of this traffic will be destined for onward transmission by rail, the facilities have been designed to this end. This is, of course, the only logical method to handle large numbers of containers with the minimum of handling and traffic congestion.

The specially designed quayside crane is of the bridge type, spanning four rail tracks and with a boom which extends over the quay. A smaller extension on the landward side enables road vehicles to be loaded on a parallel service road. The four rail tracks are to have automatic truck movement equipment which is capable of moving a whole train along the full length of the quay, and this can be controlled from the crane cab.

In operation, a container is selected from the vessel, and after identification is placed on a truck on the appropriate

track. The train is then caused to progress one truck length whilst the crane is obtaining the next container. Where possible simultaneous loading and unloading of the vessel will take place.

Such a system implies a high degree of control in marshalling, plus a knowledge of the destination and location of each container. This is to be achieved by a Telex system which will transmit the required copy of the ship's manifest whilst the vessel is in transit between ports.

14. Concluding Remarks.

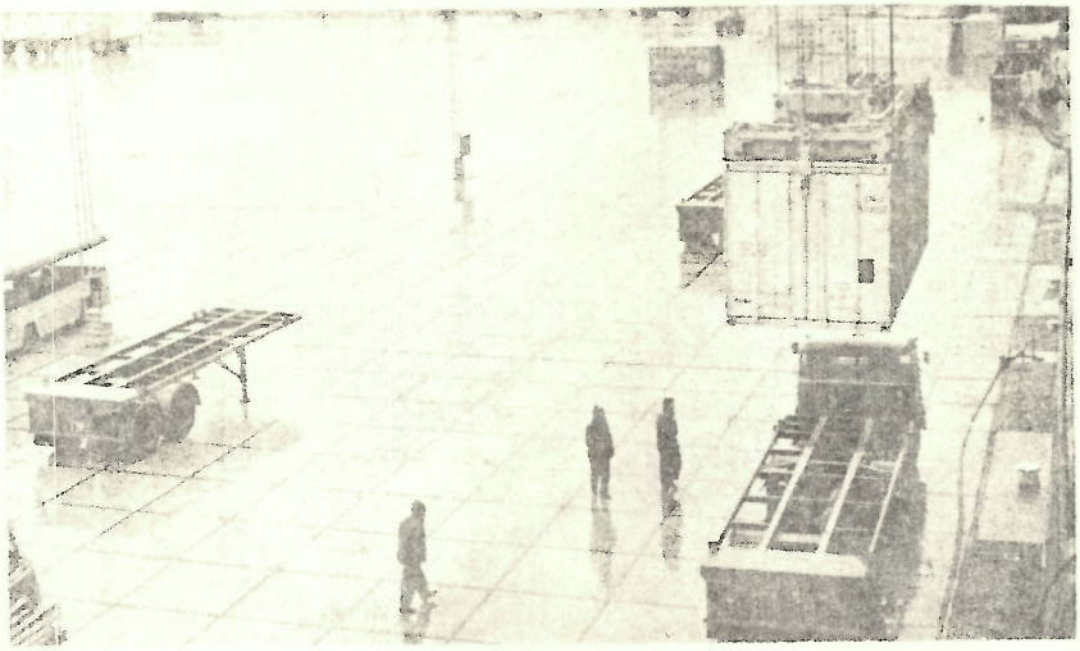
In both countries containers are considered as a new kind of traffic, imposed by the Americans, but since the expansion of this traffic is inevitable, the attitude is that they might as well participate and reap as much of the advantages as possible. Thus all planning for container docks is designed with plenty of room for future expansion, and there is, at least in Holland, a trend towards consortia of forwarding agents for containerisation of groupage traffic.

What impressed us most was the Belgian entrepreneurial spirit, their willingness to invest large sums of money, based on thorough and detailed planning. We believe that, if container traffic expands to the extent forecast in the various journals, their present investment will put them into a very advantageous position and is bound to bring in a profitable return.

There are, however, two points which seem to be neglected. In neither country, it appears, is any detailed research carried out on the impact on traffic and dock marshalling of large numbers of containers being loaded and unloaded within a short space of time. The installed and planned quayside equipment in all docks, we have seen, will ultimately be able to handle the loading and unloading of at least two container ships simultaneously at about 2 minutes per container. Thus in any hour some 60 containers will have to be moved in a relatively restricted space. Present operating performance cannot possible be a reliable guide for the conditions obtaining under full capacity working.

Documentation is the other matter on which we could learn very little. Some hopes were expressed that there will in future be a standardised document, but no actual steps seem to have been taken in this direction.

Cranfield,
January, 1968



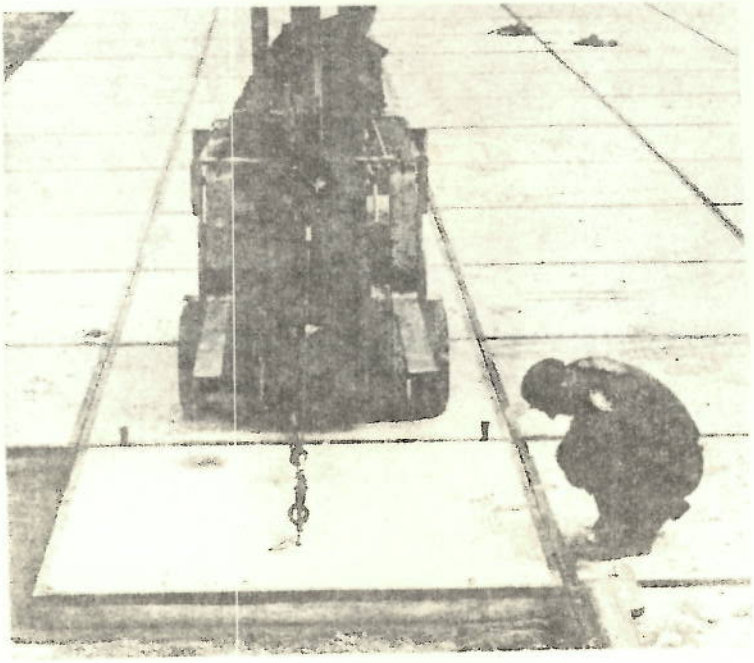


Fig. 1 Container quayside showing 2 m. squares.

Fig. 2 Individual 2 m. square concrete slabs being laid.

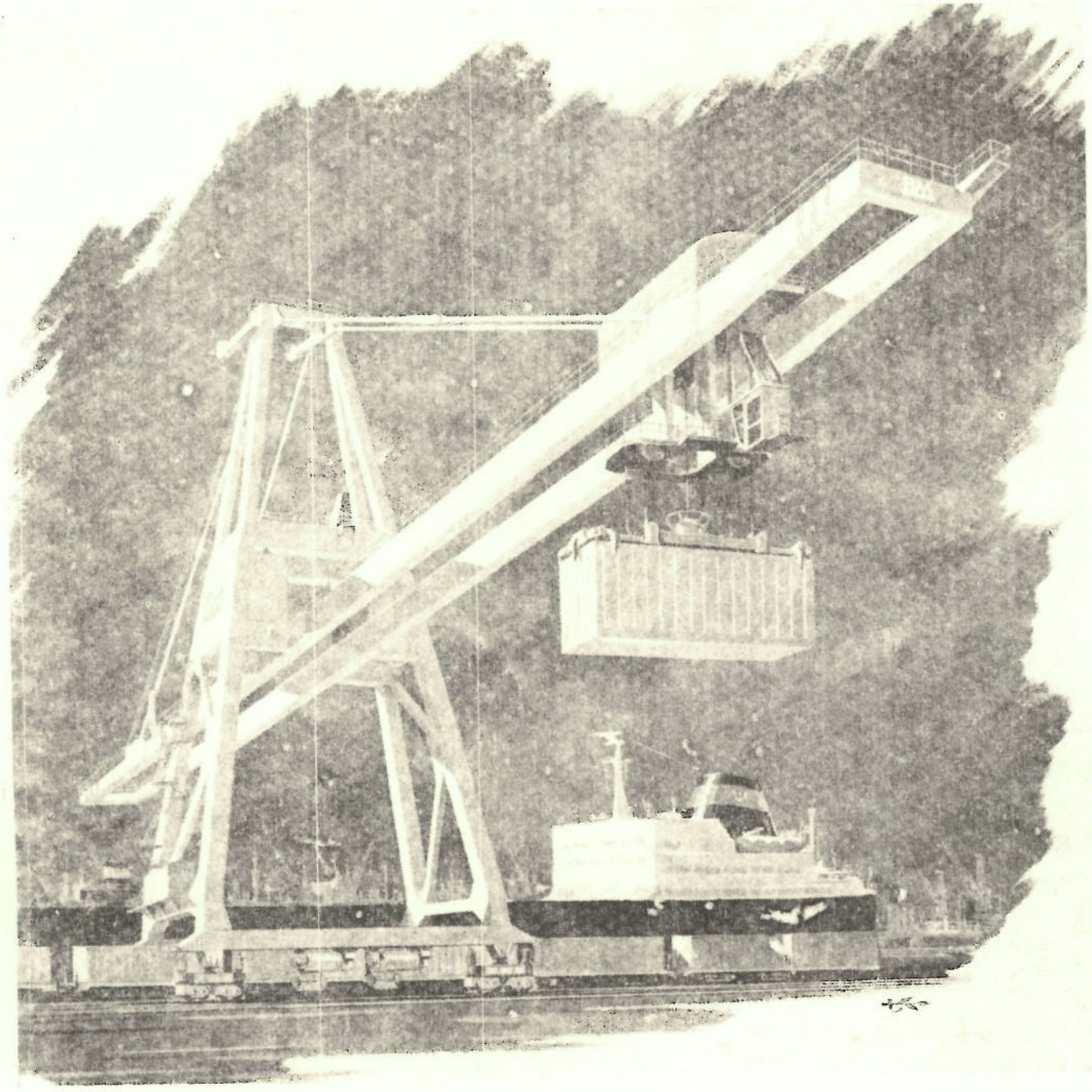


Fig. 3 Container crane of the type installed at Churchill Dock, Antwerp.

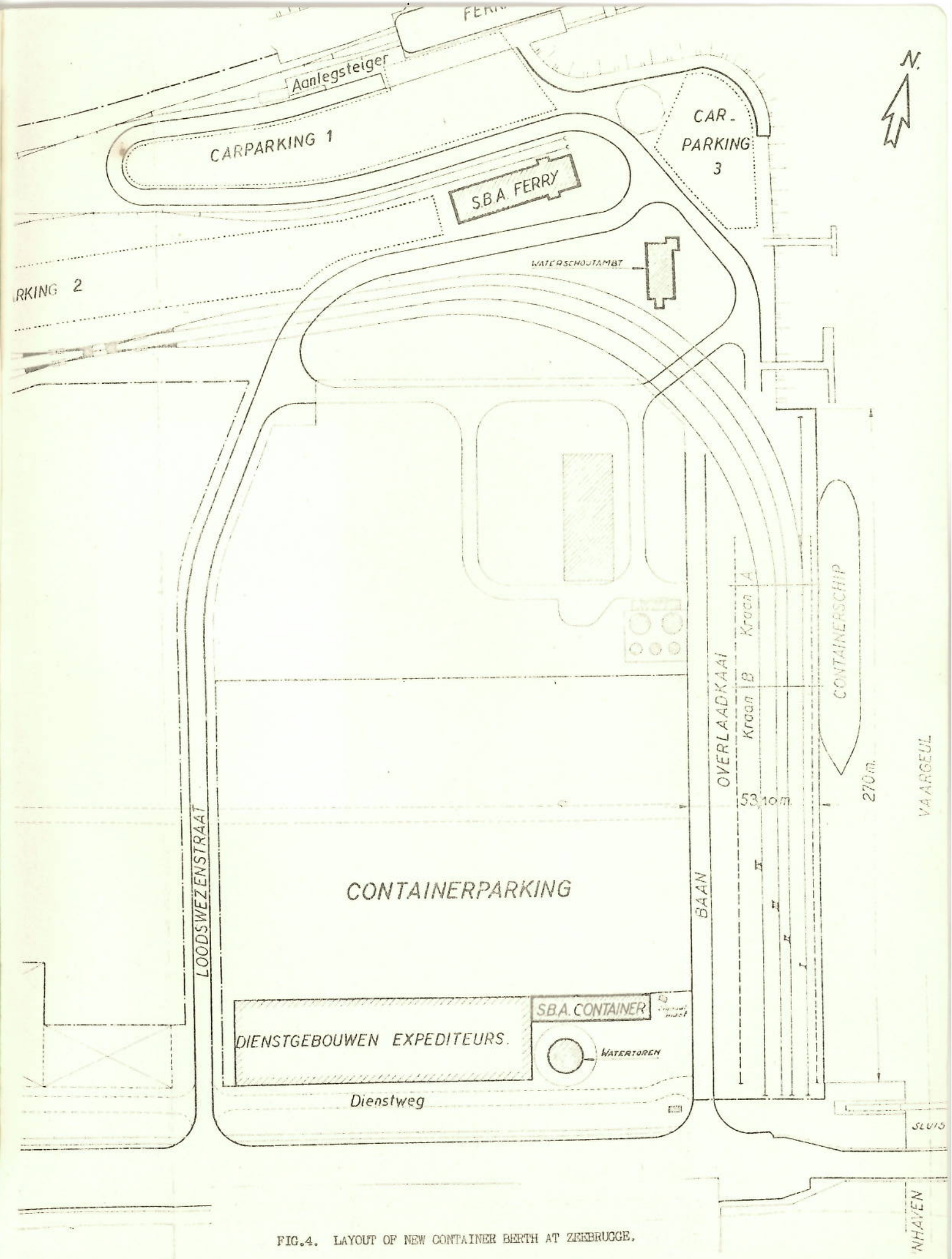


FIG.4. LAYOUT OF NEW CONTAINER BERTH AT ZEEBRUGGE.