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Some Aspects of Modern Port Development

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INTRODUCTION

In discussing modern port development I would like to follow through the evolution which has taken place, beginning with the significant cost of transportation related to our gross national product, since this points up the importance of transportation, and then the growth in world ocean borne trade which contains figures that are difficult to conceive, because of their magnitude. This growth in turn is forcing us to use larger ships, the larger ships are requiring modernization of port and harbour facilities and finally I will cover briefly the features we should expect and which are necessary in the modern port of today.

IMPORTANCE OF THE TRANSPORTATION SEGMENT

Let us first look then at the importance of the transportation segment. For the past few years, in particular since the second Suez Crisis in 1967, we have heard repeatedly the words, super ship, giant tanker, and so on. To many of us the impact of this trend towards larger ships seems often remote from our own involvement in business. But when we consider that transportation, particularly of bulk products, absorbs such a large percentage of the final cost to the consumer then we must be interested.

In Canada between 25% and 30% of our gross national product is represented by expenditures on transportation. With some commodities the transportation segment is much higher than this national average. As an example, when shipping metallurgical coal from Canada to Japan, the transportation segment of the total cost of product to the Japanese is 55%. With improved rail and deepsea shipping movements a 10% reduction of the total cost for this coal will be possible, in one particular case, representing some $65,-000,000 total saving for this one contract.

When we review figures such as these, one fact becomes abundantly clear; THE GREATEST OPPORTUNITY WE HAVE TO REDUCE THE ULTIMATE COST TO THE CONSUMER AND THUS WIDEN MARKETS IS NO LONGER IN THE PRODUCTION OF THE WORLD'S GOODS BUT IN THEIR DISTRIBUTION.

A close association with some of the major port developments around the world has given me a working knowledge of some of the dramatic changes which have occurred recently in ocean transportation. These changes, which include the handling of many new commodities such as molten sulphur, iron ore in slurry form, and nickel and copper concentrates, containers and

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unitized cargo, would not have been possible two decades ago and it appears now that new ideas will continue to develop at an ever increasing rate. The stimulation behind many of these changes has been a result of both the industrial demand for a large volume of products and a correspondingly large volume movement of raw material, as well as the overall desire to reduce the costs of these ever increasing volumes.

WORLD TRADE GROWTH

The forecast of world ocean borne trade for dry cargo contains some staggering figures which show that a considerable new ship tonnage will be required to transport this world trade volume of cargo.

As an example in less than two decades the world ocean borne trade, which has taken centuries to reach its present volume, will double. This rapid increase of world trade stems from the requirements of the shippers and customers. From here the requirements are felt back to the shipyard and shipping company, who in turn request the designer or naval architect to produce a larger ship or ocean going barge in order to meet these requirements. Thus, it will be seen that this trend toward larger vessels has not been initiated by the naval architect. The shipping companies tend to be the victim of these changes and they are constantly menaced by obsolescence of ships that they own. In a similar manner the shipyards are forced to invest in new and expanded facilities to meet this ever growing change.

TREND IN SHIP SIZES

Perhaps we should take a moment and discuss the foreseeable limit to the size of cargo vessels. I am sure you do not wish to hear a long technical discussion on the design problems of large ships, but you may be interested in knowing some of the basic considerations relating to beam, length and draft, since it is these dimensions which will directly affect both loading and unloading facilities, as well as causing problems in the design of very large ships.

Vessels at sea are continuously exposed to waves and wind and these forces are constantly changing. The motion of the ship combined with these external forces produces a condition that is most complicated and virtually impossible to estimate. As a result the hull calculations are based on the assumption that the vessel is on the sea in a static condition. In this case, the worst longitudinal condition occurs when the wave crest to crest distance equals the ship length and is referred to as the "Standard Wave" for hull calculation. Under these conditions any increase in length calls for a strength increase not in direct proportion, but in proportion to the square of the length of the vessel. As you can see from the foregoing when designing mammoth vessels it is therefore necessary to keep the hull as short as possible. Increasing the vessel beam and draft with respect to length achieves this. Increasing the draft or vessel depth yields the greatest economies since it increases the hull strength, which reduces the quantity of steel required and consequently decreases building and transportation costs. If we are able to utilize any convenient draft then from a design standpoint the construction of large carriers is no longer a technical problem. However, a major problem does arise concerning the route to be adopted for the particular ship and the port facilities to ensure sufficient depth of water. Throughout the oceans of the world there are several major areas restricting draft, as an example the Straits of Malacca limits draft to approximately 65 feet. Areas in the North Sea and off the east coast of North America have similar restrictions. Therefore, while the ship builder and designer favor the shorter and deeper vessel, there are limitations on the draft of the ship as far as navigation is concerned. Consequently, we find that the length of vessels is increasing at about the same rate as draft, and the breadth is increasing at a slightly greater rate.

In addition to hull strength there are certain other problems associated with the construction of the very large vessels. Briefly, these are: the amount of steel used is proportionately higher, the height of such vessels lowers the efficiency of the shipyard workers, technical problems as to reliability of the very large 40,000 H.P. plus, marine engine have not been completely solved, and problems of efficiency exist with the large propellers which have now reached a diameter of 30 feet.

Going now to the type of ship the opportunity to integrate dry bulk cargo movements with primary oil movements presents a considerable overall saving in cost of product carried. As a result some of the major oil companies are endeavouring to "tie in" dry bulk movements with their oil movements. This is one of the principal factors influencing the trend today, in the design of ships above 100,000 DWT. The type of ship I refer to is the combination carrier which can transport ore, dry bulk or oil and is known in shipping circles as the OBO Type or triple carrier. The OBO configuration for the large bulk carriers enables the economies of the big ship to be realized by reducing the distance in ballast to a minimum which is not possible with the single purpose ship.

The combination or OBO carrier is then the type we can expect to become much more predominant during the next decade. One can see this trend taking place today. In June of this year a total of 89 OBO carriers were on order throughout the world at an average size of approximately 120,000 DWT. At this same time the average size of single purpose dry bulk carriers on order actually dropped from 44,000 DWT to 33,000 DWT. It is also important to note that for vessels under 150,000 DWT combination carriers on order form a larger group than crude oil carriers on order in both numbers and tonnage.

We see then an obvious trend taking place with the OBO type as two or more shippers combine to provide a full cargo in an effort to enjoy the maximum economies in transportation offered by the big ship.

Going back for a moment to ship size – while it is a common fact that transportation costs are lowered with the increase in ship sizes this trend flattens out when the tonnage exceeds 200,000 DWT and for short routes the cost actually begins to increase. The reason for this is the high cost of idle time for the large vessels. For these vessels a high idle time in port is required because of the physical limitations of high capacity unloading equipment.

There are also other considerations with respect to operating economies, such as the longer unloading time facing dry bulk carriers compared to liquid cargoes. If we combine all these factors together, the results indicate that an average foreseeable limit to the size of dry bulk cargo ships will be approximately 200,000 DWT, ranging upward in some cases to 250,000 DWT, depending on route and port facilities, and downward to some of the present dry bulk carriers, which are in the order of 150,000 DWT. The shipping company, Associated Bulk Carriers, as an example, has 6 – 150,000 DWT carriers of the OBO type on order for delivery in 1972.

If there is any doubt in anyone's mind as to the advent of the very large ship let us consider for a moment the investment in shipyards and the number of these yards, either now complete or under construction. While the Japanese have tended to steal the limelight, but must also be given credit for pioneering mammoth vessels in recent years, European ship builders are also well advanced toward preparing for vessels of this size and have made strenuous efforts toward the expansion of their ship building facilities. As a result by the end of 1969 a total of 28 building docks in Europe will be complete, each capable of accommodating vessels of more than 150,000 DWT, out of which 18 of these building docks will be capable of handling ships to 200,000 DWT or over.

During the same period Japan will have a total of 11 building docks for ships of 150,000 DWT out of which 9 will be for ships 200,000 DWT or over. It should also be noted, however, that even larger building docks are being constructed in Europe to meet the growing trend for mammoth vessels and this has resulted in the emergence of a 1,000,000 DWT building dock in Europe. In mentioning some of these larger sizes of building docks I may appear to be contradicting myself in the earlier statement that the very large vessels will level off somewhere between 200,000 and 250,000 DWT. I believe this will be the average trend, but that we will also see a much smaller number of even larger vessels operating between specific points which do not have any draft limitation.

I may appear to be over-emphasizing large ships. This is not my intention. My intention is merely to indicate a realistic upper limit of vessel size since this must be one of the principal specifications in the selection of a major port. Looking for a moment at other developments, container ships are also developing at a rapid pace and five vessels with a 2,600 container capacity and a 26 knot speed are now planned for European service. Vessels of this size will be carrying nearly 1,000 more containers than the presently accepted large container vessels. A good deal of uncertainty exists right now in the North Atlantic container service as to which routes should have priority as well as some indecision as to the sizes and speeds of the vessels themselves. No doubt the sooner we can bring container facilities into operation on the east coast the better opportunity we will have to obtain some of these presently undecided routes for Canada.

It would be an error if the subject of large unmanned barges were not discussed. There is an increasing trend to utilize these vessels on the short haul ocean runs. The Mitsui Company in Japan has developed ocean going barges of the pusher type and has operated them successfully in fairly heavy seas. The more familiar tow type barges of the 20,000 DWT size are operating today over open water distances of 1,500 to 2,000 miles. It is expected that these vessels will go at least 50,000 DWT as safer and faster towing and pushing techniques are developed for the open seas. We can see, therefore, the possibility of a much wider development in the barge collection systems replacing in many cases the smaller cargo vessel. One advantage to the use of barges as carriers, and often overlooked, is that the dispatch of these vessels is almost independent of the situation in the ports. They do not appear to suffer in the same manner as ocean going vessels do with unforeseen delays due to congestion, labour disputes and slow dispatch.

The era of LASH – lighter aboard ship – has arrived. The first multiple satellite barge carrying cargo system is now in operation. This first ship was built in Japan and is owned by a Norwegian firm, but operating under charter by an American company. This first ship will begin her voyage in Panama proceeding to New Orleans then to Europe with a stop at London where some 25 barges will be discharged and then to Rotterdam where the balance of the barges, some 50 years in total, will be discharged and towed to their final distribution points, in Belgium, Holland and Germany. These barges each have a carrying capacity of over 400 tons, and the ship's crane can handle four barges an hour for a total discharge or unloading of 1,600 tons of cargo an hour.

Another recent innovation which I believe is worth mentioning is the recently developed Freedom class ship by IHI of Japan which will carry 1,000 export cars to the U.S.A. on multiple decks which fold down, returning with a full cargo of grain – this is 600 more cars than previously carried.

MODERN PORT DEVELOPMENT

So much for ship size and other developments – let us look back toward the beginning of the first harbours which historically provide some of the reasons why the renovation and modernization of most harbours of today is lagging. To begin with ancient harbours were built upon a scale of solidity and architectural grandeur seldom or never attempted in modern times. The slow increase in the size of vessels made it reasonable to build for a life of centuries and an unlimited supply of cheap manual labour made the execution of elaborate works feasible. The factor set a style and now a few words on location.

As the ships were small the ports which were natural harbours were located in the centre of the cities, because that is where the warehouses were situated and commodities were stored. It was of great importance to keep the distance between ship and warehouse to a minimum, as the only means of transport at that time was by horse and cart.

The 19th century gave us steam and with this the arrivals and departures of ships gradually became time-table bound, as part of their dependance upon the weather was removed. The effect of the introduction of steam at sea was, of course, revolutionary but it was perhaps even greater on land, where for the first time one had the means of moving great quantities of freight over vast distances at high speed.

It followed naturally that the terminals of the railways should be located in the city centres. Consequently, it became even more important to have the port installations close to the city centre to save the cost of long spur lines from the city rail yard to the port areas. As the last century ended the situation was simply that commercial aspects, local transportation conditions, railway considerations and the shallow draft of vessels required that the port installations should be as close as possible to the heart of the city.

Again at the end of the last century and the beginning of this century general cargo steamers grew in size. Ocean commerce also increased and new harbour installations were built – in most cases "further down the river", but as the cities grew the port facilities still remained within the city boundaries. Barges and railways delivered the cargoes and to some extent horses and carts were used for local transport. The railways thus ruled in the ports for about a century until the arrival of the automobile.

The next event to happen after these changes in the transportation field — steamers, trains, etc. was a gradual change in handling methods. Machines were invented to handle uniform cargoes, and this equipment demanded more space to manoeuvre. This lessened the physical strain on the docker but it led to a demand on the port authorities to modernize their installations.

These factors taken together – the bigger ships, the bigger cargoes, the congestion caused by railways and trucks having to share areas originally designed for railways only and the mechanization of the cargo handling made existing harbour areas too small.

We are now going through a tremendous growth of world ocean borne trade, a growth in ship size still endeavouring to keep up with this trade. The next evolution then which we can expect and which has already begun is the modernization of port and harbour facilities to meet these demands and in many cases an out-of-the-cities-move of harbour installations brought on by the need for more space. Today we can see a pattern of major world ports forming and in some cases these ports will render obsolete certain adjacent port areas. What is taking place is referred to as a Central Terminal Station System or CTS. It is forecast that the very large ships will operate between these stations, each one of which will take its place in the world pattern of major ports.

A good example of the CTS system is the recent establishment of the huge crude oil storage base on Whiddy Island in Bantry Bay, Ireland, where the 317,000 DWT tankers unload their crude oil cargoes. From here the oil is distributed in smaller tankers to various refineries throughout Europe. In dry bulk commodities a service such as this is handling salt and is already in operation in Japan. Such a system is particularly suited to conditions in Japan, or the U.K. and other similar areas where a large number of smaller or satellite ports are located within close proximity of major ports. It will be between the Central Terminal Stations and the smaller ports that we will find the very large barge in operation.

I firmly believe that Canada must take its place in this pattern of world ports and that in order to accomplish this fact a major deepwater port is required for both our East Coast and our West Coast of Canada. This port must be of such capacity that it can match any other facility in the world, either planned or built. Unless we take a place in this world system then ultimately we will not enjoy lower costs of product as a result of lower transportation costs that other countries can enjoy.

In order to develop a major port such as I refer to, a long range Master Plan is necessary and vital. Without this Master Plan proper land access for future needs will not be provided, port-oriented industries will not be properly located, congestion in waterfront areas will take place and so on. This Plan would take into account forecasts of growth of various commodities, allowance for future developments in both land and ocean transportation and be non-restrictive in limiting dimension.

I am not suggesting a Master Plan contain elaborate detail otherwise it will not be flexible. It must be relatively simple but contain the following basic provisions:

1. Provision of large areas of level land with good foundation conditions immediately adjacent to the berth areas. This is land for port-oriented industry which will develop because of the economies realized in short transportation distances of either finished or raw product.

2. Provision for direct and uncongested railway and highway access to the hinterland, as well as the ability to accommodate barge or small ship traffic which would feed the port area by water routes to the hinterland. In the case of railway access and as far as Canada is concerned the ability to provide access for both our national railway lines which is important in the eyes of any potential port user. The transportation from either the producer or user to tide water is part of the Total Transportation System and the segment that must be assured as without it the port will not operate.

3. Provision for direct vessel access from deepwater with present day depths to 22 fathoms or 72 feet and the ability to go deeper in the future as required.

4. Provision for remoteness from densely populated areas in order that nuisance problems which might result from occasional air, water or noise factors would be minimized.

5. Provision for very high loading and unloading rates in terminal equipment.

6. Provision to allow proper integration to take place between existing facilities such as present harbour areas and the community itself. And it goes without saying that the operation of harbour must be on a year round basis.

I may have given you the impression of criticism towards Port Authorities – let me hasten to correct this point, and again point out that it is the shipyards, ship owners and port authorities in that order who are in a sense all victims of growth in world trade. Look for a moment at a parallel – transportation by air, our most modern method of transportation, but an infant in years when compared to transportation by water and yet only one airport in the world, Orly in Paris, is able today to accept the 747 or jumbo jet. Even Pan Am at Kennedy in New York — the first airline to order the 747 — is still two years away from having facilities ready to receive these big planes.

Going back to harbours, for one segment in the Total Transportation System to lag behind another is human nature. And in the case of Port Development we have many more obstacles in the form of tradition which is centuries old, a desire to resist change and so on compared to air transportation. The important fact is to recognize that today we, Canada, must take our place in the development of a major port, to meet world standards, on both the East and West Coast.

I may also have given you the impression of undue emphasis on the growth in world ocean trade and on the increasing size and new types of ships. This aspect or trend in growth of world trade and ship size is a phenomenon imposed upon the ship builders and is now a fact. World shipping is in a period of rapid expansion — the greatest change or transition the world has ever known and unparalleled since iron and steam were introduced. For both shippers and shipowners the potential benefits are immense. Now it is the turn of the Port Authorities to face the problem of keeping up with this trend by renovating their ports and harbours and modernizing their cargo handling facilities, to eliminate this historic weak link in the Total Transportation System — this interface area between Land and Sea.