MAAMERICAN TRANSPORTATION RESEARCH
FORUM. PAPERS OF THE ANNUAL MEETING.
2nd 1961

AMERICAN TRANSPORTATION RESEARCH FORUM

1961

CONTRIBUTED PAPERS

SECOND ANNUAL FORUM

Commodore Hotel
New York, New York
December 27-29, 1961

Paper No. VI

THE DEMAND FOR AND THE SUPPLY OF GENERAL CARGO PORT FACILITIES TO HANDLE POTENTIAL OVERSEAS SEAWAY TRAFFIC

Eric Schenker
University of Wisconsin
(Milwaukee)

GENERAL CARGO FACILITIES

It has been the experience of almost all United States ports that general cargo marine terminals are not self-supporting in the sense that the direct revenues credited to these facilities are insufficient to cover their cost for maintenance, operation and debt service; therefore some type of deficit financing is necessary. Generally, this deficit financing takes one of three forms: (1) annual appropriations from state or local governments; (2) direct taxation for port purposes; or (3) revenues from other activities.[2]

In Louisiana, a portion of the state gasoline tax is allocated to the ports of New Orleans and to Lake Charles to pay off terminal revenue bonds for which terminal revenues were insufficient.[3] Other instances of tax revenue allocation by state or local governments for port purposes include Baltimore, Maryland, and the three Mississippi ports of Biloxi, Gulfport, and Pascagoula.[4]

Some of the most successful port operations in the United States employ revenues from other activities to support general cargo terminal developments. The Port of New York Authority operates profitable vehicular tunnels and bridges, the net income from which may be utilized for port purposes.[5] At Philadelphia, the Delaware River Port Authority may use net revenues from toll bridges to meet interest and principal requirements of bond issue for port development.[6] The Chicago Regional Port District includes the revenues from grain elevators together with those from its general cargo terminal development.[7] Revenues from direct taxation within a specially designated port district are available for port financing at Seattle and Tacoma, Washington, Tampa and Fort Pierce, Florida, and Houston, Texas.[8]

If such is the case, then why develop general cargo facilities? A recent bulletin of the American Merchant Marine Institute reports that the combined vessel and cargo payments of one cargo ship at an eastern port brings $1,500,000 into the community on each trip. It is estimated that a freighter docking at Port Newark, New Jersey, brings into the community $100,000 per voyage. In 1952, the port of Philadelphia estimated direct revenues from cargo shipped ranging from $1.81 per ton for coal to $11.33 per ton for general package freight. These figures vary by port, but it should be obvious that the direct revenues received for handling general cargo are much higher than for most bulk commodities. Further, it is estimated that associated services derive an additional revenue of $12.50 per ton of general cargo and generates the greatest amount of port employment.[9]

The above generalities are not cited to advocate general cargo terminal development in all communities, but to cite the need of critical examination of individual trends and situations. Where general cargo terminal development is carried on efficiently, it not only cheapens the local cost of living and doing business, by opening up new markets and source of supply, but also becomes a basic source of employment and earnings for the community. Water front activities stimulate many and varied lines of local business, such as the basic community economic activities of manufacturing, transportation, banking, and insurance. Thus, if a port is properly developed, it may be an asset of great value by contributing directly to a community's economic base.

OBJECTIVE OF THE STUDY

Many studies have been completed for individual ports on the Great Lakes dealing primarily with the local problem of additional physical facilities to be erected, their location, and their investment requirements. However, very little has been done on a regional or Great Lakes basis in measuring general cargo capacity at ports. Since the taxpayers of many areas have been asked to supply funds for general cargo terminal development, this study attempts to provide the proper economic background upon which to determine future investments for general improvements. The specific objective of this study is to evaluate the capacity of present Great Lake port facilities to handle general cargo traffic and to determine the incremental port facilities needed to handle such traffic. The study considers only general cargo facilities, since past records indicate that in most cases private industry can be expected to construct terminal facilities for handling bulk cargoes.[10]

GREAT LAKES - DEMAND FOR GENERAL CARGO FACILITIES

During recent years many estimates of the foreign overseas traffic potentials of the Great Lakes and the St. Lawrence Seaway have been made. Forecasting Seaway traffic is complex because of the many physical and commercial variables. The maximum capacity of the Seaway is set by the limitations of the Welland Canal at about 50 million short tons. It is estimated that double-locking the five single locks at the Welland Canal would increase canal capacity by 30 to 40 per cent. To enlarge the Welland Canal sufficiently to handle potential traffic quickly, mainly by the construction of a complete system of twin locks, would take at least five years of work and at least $200,000,000. The Canadian government, already working with the largest national debt in Canadian history, is shying away from such a major project. Thus, the 50 million tons maximum is realistic for forecasting.

Present St. Lawrence-Great Lakes traffic consists mainly of bulk cargo. The traffic report for the 1960 shipping season showed a total bulk cargo of 18,031,452 tons moved between Montreal and Lake Ontario, compared with 11,762,000 over the shallower old canal system in 1958. Forecasts had expected about 25 million tons, but iron ore tonnage was down, due to the recession. Welland Canal traffic between Lake Erie and Ontario was 28,800,000 tons, up from 21,274,000 in 1958.

General Cargo, per se, although relatively low in volume is increasing at a rapid rate. The importance of general cargo lies in its potential as shown in its growth from 30,000 tons of overseas cargo in 1946 to 1,875,500 tons in 1959 and an estimated 2,247,554 tons in 1960. As indicated in the introduction to this study, the importance of general cargo lies in the difference in port handling charges. Whereas one ton of bulk cargo is handled for about 40 cents to $1.50, a ton of general cargo results in charges between $5 and $12; furthermore, it is general cargo that generates the greatest amount of port employment.

Numerous forecasts of future general cargo Great Lakes traffic have been made and a summary of the forecasts are shown in Table I. In 1970 the average predicted annual volume of the Seaway will be 50 million tons, 4 to 10 million of which, as seen in Table I, will be general cargo. Comparison of the current total annual Seaway through traffic of

TABLE III

Estimated Overseas Commerce
Of United States Lake Ports,

1965 and 1970
Shipping Weight (short tons)*

Port	Anticipated Percentage of Future Traffic	1965	1970
Buffalo, New York	5%	161,051	205,547
Cleveland, Ohio	10%	322,102	411,093
Toledo, Ohio	6%	193,261	246,656
Detroit, Michigan	14%	450,943	575,530
Chicago, Illinois	40%	1,288,408	1,644,372
Milwaukee, Wisconsin	10%	322,102	411,093
Green Bay, Wisconsin	5%	161,051	205,546
Superior-Duluth (Wisconsin-Minnesota)	4%	128,841	164,437
Other Ports	6%	193,261	246,656
TOTAL	100%	3,221,020	4,110,930

*Grain & Scrap Metal Exports not included.

approximately 25 million tons with the various forecasts would indicate that an annual total volume of 30 to 40 million tons could be expected around 1965.

At the Cleveland Seaway Symposium of January 27, 1959, it was stated that two years after the opening of the Seaway 1,200,000 tons of general cargo could be expected, with a yearly increase of 10 per cent thereafter. The 1,200,000 tons has been exceeded in 1959 and 1960 by United States ports. The 1956-1959 overseas traffic figures for United States Great Lakes harbors are shown in Table II. Great Lakes ports as a group made gains in their direct overseas commerce in the first year of the Seaway. As can be seen in Table II, the Port of Chicago handles in a typical year about 40 per cent of the total, most of which is general cargo. The Port of Detroit handles about 14 per cent of the total, with Cleveland and Milwaukee handling about 10 per cent each, Toledo handling about 6 per cent and Green Bay and Buffalo an estimated 5 per cent in a typical year. There is no reason to believe that the respective ports will not retain their relative share with the remaining ports sharing the remaining volume. It does not appear, therefore, to be unreasonable to project the individual port's future general cargo tonnage through the Seaway at approximately the percentage figures indicated.

Assuming that the anticipated liner services are available, that the inland rate structure on movements through the Great Lake ports to and from their hinterland is not discriminatory, and that adequate port terminal facilities are available, the estimates of general cargo on direct Great Lakes Overseas traffic 1965 and 1970 to and from the various Great Lakes ports are shown in Table III. The projections in Table III are based on yearly increase of 10 per cent until 1965, as outlined at the Cleveland Seaway Symposium, and 5 per cent thereafter. A 5 per cent increase was assumed after 1965 since adjustment of the total general cargo moving to U. S. ports via the Seaway should have taken place. A normal growth pattern of about 5 per cent per year should then develop. A 5 per cent increase was also assumed for 1960 because of the labor situation in the early part of the shipping season.

In Table I the forecasts for general cargo in the Seaway range from 4 to 10 million tons by 1970. The 1958 Report of the U. S. Department of Commerce (Downer Report) predicted a total of 9.9 million tons of general cargo by 1970 for ports in the United States and Canada. The share of United States foreign trade, including Canadian trade, is estimated at 5.5 million tons. The volume of United States overseas cargo is stated in the same report as 4.17 million tons. On the basis of this projection, Table IV shows the prediction of United States overseas general cargo trade for Great Lakes ports in 1970.

According to the analysis presented in Table IV, the Port of Chicago will continue to be number one, with about 40 per cent of the total general cargo moving via the Seaway. The Port of Detroit will rank second, with the Ports of Milwaukee and Cleveland either third or fourth. The expected gains of the Seaway for various ports is based on the principle that ships follow cargo. This also assumes availability of sufficient port facilities and auxiliary services and an effective port promotion program.

TABLE I

Forecasts of Total Great-Lakes -St. Lawrence Seaway Through Traffic, U.S. and Canadian by Commodities (In Thousands of short tons)

	Coal and Coke	Iron Ore	Non-Ferrous Ore	Petroleum Products	Wood Pulp and Pulpwood	Grain	Estimated Total Bulk Commodities	General Cargo	Total
Average for 1950-54	1 646	216	77	1 547	550	3 481	7 520	1 362	8 879
Buckley Report: 1959	4 000	8 100	500	2 500	1 000	7 500	23 500	6 400	30 000
1965	5 000	13 000	750	3 000	1 250	9 000	32 000	8 000	40 000
1970	6 000	17 000	1 000	3 500	1 500	12 100	41 000	9 000	50 000
St. Lawrence Seaway Dev. Corporation: 1959	3 700	10 500*	800	2 300	700	12 000	30 000	6 400	36 500
1965	———	———	———	———	———	———	———	———	52 000
Canadian Department of Trade & Commerce**	4 200	20 000	———	1 091	1 165	8 200	———	9 876	First Est: 44 532 Revised Est: 31 000
Great Lakes-St. Lawrence Association**	6 000	20 000	1 000	2 000	1 000	10 000	40 000	5 700	45 700
U.S. Dept. of Commerce: Minimum:	4 000	30 000	240	6 000	———	6 500	46 700	11 038***	57 778
Maximum:	4 000	37 000	240	20 000	———	11 500	73 000	11 038***	84 278
The American Ship Building Company		MAXIMUM CAPACITY OF SEAWAY							40 000
U.S. Maritime Administration - 1970								4 000	
N.Y. Times-St. Lawrence Seaway Issue		ESTIMATE FOR YEARS 1960-62						1 250	30-35 000
		1965							52 000
U.S. Dept. of Commerce-1958 Downer Report Maximum	6 000	37 000	———	20 000	———	12 100	76 000	11 000***	87 000
Minimum	4 000	20 000	———	1 100	———	6 500	31 600	6 700***	39 300
Average	4 800	22 900		3 200		9 200	40 000	9 900***	50 000

*Changed later to 18,000
**Estimates based on a period of 5 to 10 years after completion of Seaway
***Contains pulpwood, sand and other bulk products

TABLE II

Total Overseas Imports and Exports of Liner Type General Cargo Via United States Great Lakes Harbors and the St. Lawrence Seaway: Actual Traffic By Harbors. 1952-1959. (1)

Port	Actual Traffic, 1952-1959					Percentage Distribution	
	Avg. Annual 1952-58	1956	1957	1958	1959	Avg. Annual 1952-58	1959
	(1,000 short tons)						
TOTAL	492.9	574.1	518.9	707.8	1875.5	100.0	100.0
Lake Ontario & St. Lawrence River	0.5	*	0.3	2.9	7.9	0.1	0.4
Ogdensburg	*	-	0.3	*	0.1	-	-
Clayton	-	-	-	-	-	-	-
Cape Vincent	*	-	-	-	-	-	-
Oswego	0.4	-	-	2.3	3.1	0.1	0.2
Rochester	0.1	*	*	0.6	4.7	-	0.2
Lake Erie, Detroit & St. Clair River & Lake Huron	167.5	175.9	159.7	213.6	718.3	34.0	38.3
Port of Buffalo	7.0	7.0	8.2	13.7	95.9	1.4	5.1
Erie	*	-	-	-	3.6	-	0.2
Ashtabula	-	-	-	-	3.2	-	0.2
Cleveland	45.0	57.5	49.0	68.0	186.5	9.2	9.9
Lorain	*	-	-	-	0.1	-	-
Toledo	24.6	17.1	31.5	30.6	113.7	5.0	6.1
Sandusky	-	-	-	-	*	-	-
Port of Detroit	85.0	90.3	68.6	87.2	262.6	17.3	14.0
Port Huron	3.5	4.0	2.4	2.3	4.2	0.7	0.2
Marysville	0.2	*	-	-	-	-	-
Saginaw River	2.2	-	-	11.8	48.5	0.4	2.6
Lake Michigan & Lake Superior	324.9	398.2	358.9	491.3	1149.3	65.9	61.3
Manistee	*	-	-	-	-	-	-
Muskegon	7.9	15.0	17.5	17.1	47.7	1.6	2.6
Grand Haven	0.4	-	-	-	-	0.1	-
Holland	*	-	*	-	-	-	-
South Haven	12.5	13.8	10.2	17.5	27.0	2.5	1.4
St. Joseph	0.1	-	-	0.4	-	-	-
Buffington	0.5	-	-	3.8	-	0.1	-
Indiana Harbor	1.1	*	1.7	-	-	0.2	-
Port of Chicago	199.7	237.2	208.5	314.9	772.7	40.6	41.2
Kenosha	0.2	0.3	0.2	0.7	4.2	-	0.2
Milwaukee	52.4	83.9	56.4	67.0	177.8	10.6	9.5
Sheboygan	8.3	9.3	10.6	7.8	14.9	1.7	0.8
Manitowoc	0.1	0.7	-	-	-	-	-
Green Bay	33.3	29.2	51.1	40.6	73.0	6.8	3.9
Menominee	0.4	1.4	-	-	-	0.1	-
Duluth-Superior	8.0	7.4	2.7	21.4	32.0	1.6	1.7
Marquette	-	-	-	-	*	-	-

(1) Grain exports are not included in the data for 1959 but are included in the data for 1958 and prior years when such traffic was very limited.

* Less than 50 tons

Source: U.S. Army Corps of Engineers

TABLE IV

Prediction of the Volume of Overseas Cargo for Great Lakes Ports in 1970

City	Volume	Percentage of Total
Chicago	1 668 000	40%
Milwaukee	513 000	12
Detroit	705 000	17
Cleveland	375 000	9
Toledo	250 000	6
Green Bay	288 000	7
Other Ports	371 000	9
	4 170 000	100%

Source: "Engineering Study of the Effects of the Opening of the St. Lawrence Seaway on the Shipping Industry," U. S. Department of Commerce, March 1958, Washington, D. C.

As indicated, in recent years, many estimates of the foreign overseas traffic potentials of the Great Lakes and the St. Lawrence Seaway have been made. All, of necessity, had to be made without benefit of information available to the U. S. Corps of Engineers. In 1957 the U. S. Corps of Engineers requested the Bureau of the Census to undertake a survey of selected commodities comprising principally general type commodities and some bulk commodities in the United States export and import water-borne trade. This survey was designed to furnish part of the data needed for a general cargo traffic analysis of the Great Lakes harbors.

The Census Bureau study was completed in 1959, and the Great Lakes harbor study, which will determine the advisability of further improving Great Lakes harbor facilities in the interest of the present and prospective deep draft commerce, has just been completed. The approach used in the traffic analysis in the Great Lakes Harbor study is similar to that used in many navigation studies, but a few additions were required by the different problems related to Great Lakes overseas general cargo traffic. The most significant steps in the method and results obtained by the U. S. Corps of Engineers are outlined as follows:[11]

(a) Determination of the overseas water-borne foreign trade that originated or terminated in the Great Lakes area during the most recent year for which data are available;

(b) Projection of that overseas water-borne foreign trade of the Great Lakes area for the next 50-year period;

(c) Estimation of the future traffic potential for the total system of United States Great Lakes harbors based upon, (1) the most economical alternative routing, (2) the Great Lakes-St. Lawrence navigation season, (3) the shipping services and (4) other factors; and

(d) Allocation of the future potential traffic of the total Great Lakes system of harbors to the individual harbors. This includes adjustment of that traffic for the factors controlling the routing of traffic via each harbor. The results are shown in Table V. Final individual port projections have not been released, but reliable sources indicate that the predictions of the volume of overseas cargo for the Great Lakes ports presented in Tables III and IV are very close to the Corps of Engineers projections.

THE SUPPLY OF GENERAL CARGO PORT FACILITIES

In evaluating adequacy of existing and future port facilities, consideration must first be given to the type of vessel and the various types of cargoes which will use these facilities. Studying a breakdown of the general cargo flow through the Seaway, it seems evident that there are many different classifications of commodities, and their destinations are markedly different; therefore, shipping companies interested in Seaway general cargo trade expect the general cargo vessel to be of the C2-S-B1 type vessel with a 7,500-ton average cargo capacity and a length of about 460 feet. Some of the small 250-foot ships now in the Seaway trade have been lengthened and probably will carry a maximum of 4,500 to 5,000 tons. Thus, it is a reasonable expectation that the movement of cargoes in ships carrying less than 3,500 tons will tend to decline after the connecting channels and the Seaway ports have been deepened.

The rate of loading and discharging at the coastal ports of the United States varies greatly, but in general it is not worthwhile for a large general cargo vessel to stop for less than 500 tons. The average is probably nearer 1,200 to 2,000 tons per ship. In the case of Seaway traffic it is expected that the average will be less tonnage per port of call than is the case for coastal ports. Thus, as Seaway traffic develops after 1961, the average call for the large Seaway vessel should be for about 700 to 1,000 tons of cargo with a minimum of 500 tons per stop. Evaluation of existing facilities will be based on this assumption.

For the purpose of discussing the operating capacity of a general cargo terminal, a modern transit-shed pier on the East Coast will be compared to the Great Lakes operations. This operation was selected because cargo handled at this modern transit shed is typical of the type of cargo which will move through the Seaway.

With a fairly regular flow of traffic, the Port of New York Authority's modern pier at Hoboken handled 130,000 tons per berth per year through a pier-shed of 90,000 square feet for each berth. From this example, a coefficient is obtained of about 1.5 tons per square foot of transit-shed area per year for a pier equipped with the latest modern transit shed. The average cargo vessel calling at this pier, which may be operated every day of the year, has a capacity of about 12,500 tons as compared with the 7,500 tons of the Seaway-type carrier. These 12,500 measurement tons occupy 500,000 cubic feet, and this is the volume for which storage space must be provided within the shed. Most of this cargo can be placed on pallets and stacked three tiers high. These three tiers are about 15 feet high, less 6 inches for each of the three pallets--or have a net height of approximately 13-1/2 feet. The floor area requirement, therefore, is 36,000 square feet if all the stacks are full height, but some stacks are short because of broken lots. To allow for the inevitable lost space, the 36,000 square feet theoretically required are increased 25 per cent to 45,000 square feet. Another 45,000 square feet is required for working aisles, truck roadways and truck loading areas. The total gross area requirement, 90,000 square feet per ship berth has been adopted by the Port of New York 1 Authority as the minimum for a modern general cargo berth, which has been applied to the design of its new marine terminal facilities.[12]

TABLE V

Total Overseas Imports and Exports of Liner Type General Cargo via United States Great Lakes Harbors and the St. Lawrence Seaway: Actual Traffic by Harbors, 1952-1959 and Estimated Potential Traffic by Lake Areas, 1984 (1)

Port	Actual Traffic, 1952-1959 Avg. Annual 1952-1958	1956	1957	1958	1959	Potential Traffic 1985	Percentage Distribution Avg. Annual 1952-8	Percentage Distribution 1959
TOTAL	492.9	574.1	518.9	707.8	1875.5	6700.0	100.0	100.0
Lake Ontario & St. Lawrence River	0.5	*	0.3	2.9	7.9	100.0	0.1	0.4
Ogdensburg	*7	-	0.3	*	0.1		-	-
Clayton	-	-	-	-	-		-	-
Cape Vincent	*	-	-	-	-		-	-
Oswego	0.4	-	-	2.3	3.1		0.1	0.2
Rochester	0.1	*	*	0.6	4.7		-	0.2
Lake Erie, Detroit & St.Clair River & Lake Huron	167.5	175.9	159.7	213.6	718.3	2700.0	34.0	38.3
Port of Buffalo	7.0	7.0	8.2	13.7	95.9		1.4	5.1
Erie	*	-	-	-	3.6		-	0.2
Ashtabula	-	-	-	-	3.2		-	0.2
Cleveland	45.0	57.5	49.0	68.0	186.5		9.2	9.9
Lorain	*	-	-	-	0.1		-	-
Toledo	24.6	17.1	31.5	30.6	113.7		5.0	6.1
Sandusky	*	-	-	-	*		-	-
Port of Detroit	85.0	90.3	68.6	87.2	262.6		17.3	14.0
Port Huron	3.5	4.0	2.4	2.3	4.2		0.7	0.2
Marysville	0.2	*	-	-	-		-	-
Saginaw River	2.2	-	-	11.8	48.5		0.4	2.6
Lake Michigan & Lake Superior	324.9	398.2	398.9	491.3	1149.3	3900.0	65.9	61.3
Manistee	*	-	-	-	-	-	-	-
Muskegon	7.9	15.0	17.5	17.1	47.7		1.6	2.6
Grand Haven	0.4	-	-	-	-		0.1	-
Holland	*	-	-	-	-		-	-
South Haven	12.5	12.8	10.2	17.5	27.0		2.5	1.4
St. Joseph	0.1	-	-	0.4	-		-	-
Buffington	0.5	-	-	3.8	-		0.1	-
Indiana Harbor	1.1	*	1.7	-	-		0.2	-
Port of Chicago	199.7	237.2	208.5	314.9	772.7		40.6	41.2
Kenosha	0.2	0.2	0.2	0.7	4.2		-	0.2
Milwaukee	52.4	83.9	56.4	67.0	177.8		10.6	9.7
Sheboygan	8.3	9.3	10.6	7.8	14.9		1.7	0.8
Manitowoc	0.1	0.7	-	-	-		-	-
Green Bay	33.3	29.2	51.1	40.6	73.0		6.8	3.9
Menominee	0.4	1.4	-	-	-		0.1	-
Duluth-Superior	8.0	7.4	2.7	21.4	32.0		1.6	1.7
Marquette	-	-	-	-	*		-	-

(1) Grain exports are not included in the data for 1959 and 1985 but are included in the data for 1958 and prior years when such traffic was very limited.

* Less than 50 tons

Source: U.S. Corps of Engineers

The average tonnage of cargo handled each ship stop is an important factor in evaluating the capacity of piers. At the Port of New York, the opportunity for large pick-ups is greater than will be the case of Great Lake ports. At New York, cargo vessels entering or leaving frequently make only one or two stops. On the other hand, ships stopping at various Great Lake ports will make several other ports-of-call and will handle smaller pick-ups and unloadings than at New York piers. It is also necessary to recall that the ships stopping at Great Lakes ports will be smaller than the average ocean freighter operating in and out of New York harbor.[13]

Therefore, in this analysis the larger four-hatch 7,500-ton vessel equipped with the most modern handling equipment will be the basis of the study. With mixed cargoes, modern vessels at the East Coast terminal has a maximum hatch capacity of about 35 or 40 tons per hour. Older vessels with less efficient equipment and with less experienced hatch crews may average only 20 tons per hour. For figuring hatch capacity with the 1960-1965 type of modern 7,500-ton ship, it is believed that an average hourly capacity of about 30 tons per hatch or 120 tons per hour per four-hatch vessel can be obtained after the stevedores working at the Great Lakes terminals have acquired the necessary experience. This would mean about 960 tons per vessel for each regular 8-hour shift Since overtime is quite expensive, allowance is made for not more than 20 per cent for overtime It is assumed that ships will work at the Great Lakes terminals an average of six days per week, stopping work only on Sundays and holidays.

In determining the length of the average Seaway season for the terminals at various Great Lakes ports, allowance must be made for the first ship of the season to enter and to transit the Seaway locks and channels after ice has been broken in the spring; similarly, allowance must be made for the last vessel of the season to get through the same locks and channels before a solid freeze in the late fall. The average length of the overseas navigation season for Lake Superior is 249 days, the Sault Lakes 251 days, Lake Michigan 259 days, Mackinaw Straits 251 days, Lake Huron 251 days, Lake Erie 269 days, the Welland Canal 240 days, Lake Ontario 249 days, the St. Lawrence Canal 235 days, and the St. Lawrence River 240 days. Thus, for most Great Lakes ports the general cargo shipping season will average about 220 days. After deducting Sundays and holidays, there will be about 185 working days at the Port.[14]

At the maximum average rate of 960 tons per ship per day, we thus obtain a theoretical capacity of about 178,000 tons per berth per season, with 100 per cent occupancy. Of course, 100 per cent occupancy will never be obtained in practice. A review of experience of the East Coast terminal indicates that an occupancy, on the average from 29 to 43 per cent. The corresponding berth occupancies are 29 per cent of the calendar days in a year for a one-berth terminal, 38 per cent for a two-berth terminal, and 43 per cent for a three-berth terminal. It is estimated that with careful preplanning, a 35 per cent occupancy factor can be obtained at the Great Lakes ports as the average of five or more seasons.[15] The berth occupancy in Chicago varies from less than 15 per cent at some general cargo terminals to more than 50 per cent at others.[16] This occupancy factor does allow for interruptions of work due to strikes, storms, and/or other reasons. On this basis, an actual operating capacity is obtained of about 62,000 tons per berth for the average season for a modern well-run terminal. Tippetts-Abbett-McCarthy-Stratton Engineers used 70,000 tons per year as a practical capacity for a single berth in the port development plan for Chicago

The practical operating capacity for a modern terminal is based upon a modern pier which has at least 42,000 square feet of transit shed for each berth and a water depth of 27 feet to correspond to the depth of the Seaway. The height of the apron is assumed to be 16 to 18 feet above mean low water to fit the larger Seaway carriers. Further, on past experience Tippetts-Abbett-McCarthy-Stratton estimate that space is required at a modern terminal for 12 rail cars and 23 trucks at each berth. Two rail switching movements per day is customary at most general cargo terminals, thus providing the equivalent to about 24 carloads at an average of about 20 tons per carload.

Based on the assumption as outlined above, that a berth at a lake port equipped with a transit shed will have an operating capacity of 62,000 tons per season, it is further estimated that the average open-storage pier will have a somewhat higher operating capacity of about 71,000 tons per berth per season. Both of these estimates allow for the shorter season of open navigation through the Seaway. In evaluating the practical operating capacities of the future and existing general cargo terminals available to handle Seaway traffic, the coefficients outlined will be applied.

Even though criteria for measurement of general cargo facilities have been presented, it must be emphasized that terminal design cannot be standardized. Kenosha, Wisconsin, is a good example, since two of its three docks have no rail facilities. Kenosha has become a port of entry for foreign cars and also has a contract to handle military cargo. Thus, the measurement of the practical operating capacities of existing facilities becomes a little more difficult. A great deal of construction is going on at the present time, and the following estimates are for the 1961 shipping season. These estimates considered the criteria discussed and the special commodities handled at this port.

To indicate how the criteria discussed may be applied to individual terminals, the North Side terminal can be used as an example. The ideal terminal with adequate depth of water, well-paved aprons sufficiently elevated from water level for efficient operation of ship's gear, adequate transit shed area, adequate open storage area, highway and railroad approaches and loading and unloading capacity should have as a practical annual operating capacity of 62,000 tons for a single 500-foot berth.

The 62,000 tons per berth is based upon 185 working days and an average rate of 960 tons per ship per day. Thus a theoretical capacity of about 178,000 tons per berth per season, with 100 per cent occupancy is obtained. Using a 35 per cent occupancy factor, an actual operating capacity of about 62,000 tons per berth for the average season is obtained.

The North Side terminal frontage could accommodate two Seaway vessels of 450-foot length. For these two berths the terminal has one transit shed 14,400 square feet of usable space and 74,687 square feet of open storage area; furthermore, this terminal has no rail or heavy lift facilities. The water depth today is 25 feet, but it would be a simple matter to dredge to obtain the same depth as the Connecting Channels, which will be 27 feet. This dredging is necessary for this terminal to qualify for full-draft Seaway traffic.

Using a coefficient of 1.5 tons per square foot of transit area per season for a pier equipped with the latest modern equipment, 21,600 tons is obtained. Since the terminal has open storage area, but no rail or heavy lift facilities, an annual practical operating capacity of about 25,000 tons is estimated. The total practical operating capacity for the two existing general cargo terminals for the 1961 shipping season in Kenosha is estimated at about 175,000 tons annually. It should be pointed out that the Port of Kenosha handled approximately 35,000 tons of general overseas cargo in the 1960 shipping season; this includes military cargo not included in the U. S. Corps of Engineers data.

Recently this writer completed a monograph published by the Bureau of Business Research and Service, University of Wisconsin, in Madison, which included the following summary table:[18]

TABLE VI

SUMMARY TABLE OF ESTIMATED ANNUAL PRACTICAL OPERATING CAPACITIES OF PORTS INCLUDED IN THE UNIVERSITY OF WISCONSIN STUDY (TONS)

Port	Estimated Annual Practical Operating Capacity, 1960	Estimated Annual Practical Operating Capacity, 1962
Kenosha, Wisconsin	100 000	175 000
Milwaukee, Wisconsin	360 000	688 000
Green Bay, Wisconsin	169 000	710 000
Superior-Duluth (Wisc.-Minn.)	248 000	674 000
Chicago, Illinois	800 000	1 300 000

For an over-all view of the importance of the Seaway to the above-mentioned ports, the approaches and methods adopted to obtain the data for Table VI, reference should be made to the author's previously mentioned general capacity study.[19] The general cargo capacity available for the future Seaway traffic at the remaining major ports is summarized in Table VII. A Port Development Questionnaire was distributed to twenty-five Great Lakes ports and the answers furnished by the various port directors were used along with published data to complete Table VII.

TABLE VII

SUMMARY TABLE OF ESTIMATED ANNUAL PRACTICAL OPERATING CAPACITIES OF PORTS NOT INCLUDED IN THE UNIVERSITY OF WISCONSIN STUDY (TONS)

Port	Estimated Annual Practical Operating Capacity, 1960	Estimated Annual Practical Operating Capacity, 1962
Buffalo, New York	100 000	200 000
Cleveland, Ohio	400 000	500 000
Toledo, Ohio	186 000	443 000
Detroit, Michigan	300 000	300 000*
Other Ports	150 000	300 000

* No estimate attempted.

The practical operating capacities of the existing and planned general cargo terminals on the Great Lakes have been estimated and are shown in Tables VI and VII. For these estimates, the number of berths available was based on the theoretical analysis of an ideal terminal conforming to the requirements of the larger vessels expected at the Great Lakes ports upon the completion of the entire Seaway project. The estimates at Detroit, Michigan, and Cleveland, Ohio, were based upon reports prepared for the respective cities.[20] The estimated annual practical operating capacities for 1962 are dependent upon the assumption that construction will be advanced to the indicated capacities. Thus, they may be under construction and completed by a later date. No estimate of future practical operating capacity for Detroit, Michigan, has been attempted due to the political uncertainties involved. It should be pointed out that the practical operating capacity of 62,000 tons for a transit-shed berth and 71,000 tons per season for an open storage berth are based upon 35 per cent occupancy. This is good theoretically as well as practically, even though it might have been exceeded at some terminals in 1959 and 1960. This is due to the shortage of general cargo (covered) space at some Great Lakes ports. This situation cannot be maintained for a long period of time with the development of new terminals throughout the Great Lakes area.

SUMMARY AND CONCLUSION

Most ports discussed in this paper have been developed to their present position largely through the efforts of private industry, who have extended large sums for the development of marine terminals. Most of these facilities are designed to handle bulk cargoes which, as at almost all Great Lakes ports, comprise the major share of the total tonnage. On the other hand, private industry at most ports has been reluctant to make large-scale investments in new general cargo marine terminals, Green Bay being one exception, since the return from investments is small or nonexistent. The economic benefit to the port area from the development of general cargo terminals and subsidiary facilities has been discussed and it should be clear why public port agencies usually develop such facilities.

The sections dealing with the demand for and the supply of general cargo port facilities to handle potential overseas Seaway traffic are summarized in Table VIII.

TABLE VIII

SUMMARY TABLE: THE DEMAND FOR AND THE SUPPLY OF GENERAL CARGO PORT FACILITIES TO HANDLE POTENTIAL OVERSEAS SEAWAY TRAFFIC (TONS)

Port	Estimated Annual Practical Operating Capacity		Actual 1959* Demand	Potential Demand	
	1960	1962		1965*	1970*
Buffalo, New York	100 000	200 000	95 900	161 051	203 547
Cleveland, Ohio	400 000	500 000	186 500	322 102	411 093
Toledo, Ohio	186 000	443 000	113 700	193 261	246 656
Detroit, Michigan	300 000	300 000**	262 600	450 943	575 530
Chicago, Illinois	800 000	1 300 000	772 700	1 288 408	1 644 372
Milwaukee, Wisc.	360 000	688 000	177 800	322 102	411 093
Green Bay, Wisc.	169 000	710 000	73 000	161 051	205 546
Superior-Duluth (Wisc.-Minn.)	248 000	674 000	32 000	128 841	164 437
Other Ports	250 000	400 000	161 300	193 261	346 656
TOTAL	2 813 000	5 215 000	1 875 500	3 221 020	4 110 930

* Grain and scrap metal exports not included.
** No estimate attempted

The summary table indicates that 2 million to 4.1 million tons of overseas Seaway traffic, excluding grain, should be available to the Great Lakes ports during the period 1961-1970. The analysis of the supply of general cargo terminal facilities in the Great Lakes area indicates that only the new terminals meet the requirements of the theoretical ideal with adequate depth of water, well-paved aprons sufficiently elevated from water level for efficient operation of ships' gear, adequate transit-shed area, adequate open storage area, highway and railroad appoaches and loading and unloading capacity. Some of the old terminals have one or more of these qualifications, but few have a completely efficient operating setup.

While in some respects these facilities are not ideal it should be borne in mind that they have a capacity today to handle the anticipated 1961 tonnage. Further, facilities now under construction or planned for completion prior to 1965 will do much to improve the over-all utility and efficiency of of the Great Lakes ports. It is only logical to conclude that Great Lakes ports cannot expect to capture any substantial tonnage from each other due to the lack of general capacity. Toledo, Ohio, might be an exception due to the political uncertainties in Detroit, Michigan.

Table VIII also indicates that most of the major general cargo ports will be faced with excess capacity for a considerable period. Individuals might argue with the methodology used in the determination of the demand and supply figures in Table VIII, but the most optimistic traffic estimates and the most conservative measure of capacity could not change the first sentence of this paragraph.

Most of the major Great Lakes ports will have adequate capacity to handle their share of anticipated general overseas Seaway traffic so that competitive ports cannot expect to gain any substantial percentage of this traffic. This statement, standing by itself, is a fair appraisal of the capacity analysis. However, it should be pointed out that factors of port accessibility, port reliability, labor productivity, promotion and community attitudes may induce cargo to move to one port in preference to another. As Harry Brockel, Port Director, Port of Milwaukee, stated, "Where physical facilities are ample in two competing gateways, other decisive factors will assert themselves to determine the volume and patterns of traffic flow."

All available evidence indicates that the Seaway will tend to concentrate general cargo at the larger ports such as Cleveland, Chicago, Milwaukee, Detroit and Toledo; even more so as excess capacity increases. Small ports will find it more difficult to compete with adjacent larger ports for Great Lakes Overseas general cargo traffic not only because of the expected excess capacity, but also the lack of an immediate metropolitan area with a large production and consumption potential. In addition, they also lack many ancillary services essential to general cargo shippers and receivers. Further, increasingly costly operations of the larger Seaway vessels will tend to reduce irregular calls for small tonnages.

For these reasons, it will become progressively more difficult for small ports to attract regularly scheduled service, or to compete with the larger established ports for overseas general cargo. These facts should be considered by local and state agencies before any new investment is made for general cargo facilities. This statement does not mean that no small port should build a new general cargo terminal per se. A small terminal might have economic justification if the local hinterland can support such a facility.

All available evidence indicates small ports would benefit more from the stimulus of new industrial expansion in the area than directly from the Seaway itself, and therefore should undertake a comprehensive well-planned development program to attract new industry. The results of such a program could in time justify the expansion of port facilities.

FOOTNOTES

1. The preparation of this study has been made possible by a research grant provided by the Research Committee, the University of Wisconsin and summer salary support provided by the Bureau of Business Research and Service, University of Wisconsin. The author gratefully acknowledges the financial aid provided by both organizations.

2. Tippetts, Abbett, McCarthy, Stratton Engineers, Port of Chicago Development Plan (New York: August 1957), p. 67.

3. Eric Schenker, A Port Authority for the State of Florida, (Publication No. 24,356, University of Florida, Gainesville, Mic 57-3973), pp. 53-58.

4. Tippetts, Abbett, McCarthy, Stratton Engineers, op. cit., p. 67.

5. Eric Schenker, The Future of the Port of New York (unpublished Master's Thesis, University of Tennessee, 1955), pp. 186-187.

6. Delaware River Port Authority, Report of the Delaware River Port Authority to the Governors and Legislatures of the Commonwealth of Pennsylvania and the State of New Jersey, (Camden: Delaware River Port Authority, 1959).

7. Harold M. Mayer, The Port of Chicago and the St. Lawrence Seaway (Chicago: University of Chicago Press, 1957).

8. Tippetts, Abbett, McCarthy, Stratton Engineers, op. cit., p. 68.

9. Walter P. Hedden, Rochester-Monroe County Port Survey, (New York: Port Development Consultant, June 1957) pp. 14-15.

10. General Cargo. The term "general cargo" as distinguished from bulk cargo refers to items of cargo which form discrete units--packages, boxes, bails, individual pieces of machinery--as contrasted with cargo which flows and which can be handled by gravity methods or by pumps.

11. U. S. Corps of Engineers, Great Lakes Harbor Study, October 1960.

12. Frank W. Herring, "Design of General Cargo Marine Terminals", Transactions of American Society of Civil Engineers, Vol. 121, 1956, p. 437.

13. Basis for part of the analysis presented herein; Great Lakes-St. Lawrence Association, Special Report on Seaway Traffic Potential and Existing Port Facilities, Port of Greater Detroit, prepared for the Port of Detroit Commission, September 1956, pp. 34-61.

14. Some port directors might disagree with this conservative estimate.

15. Unpublished paper by Frater, Goodman, Brant (Engineers, Tippetts, Abbett, McCarthy, Stratton) entitled Prediction of Maximum Practical Berth Occupancy.

16. Tippetts, Abbett, McCarthy, Stratton Engineers, Port of Chicago Development Plan (New York: August 1957), p. 29.

FOOTNOTES, Page 2

18. Eric Schenker, An Evaluation of General Cargo Capacity in Wisconsin (Madison: Bureau of Business Research Service, University of Wisconsin, 1961).

19. Ibid.

20. Buckley Report for the City of Cleveland and the Great Lakes-Association Report for the City of Detroit.