



**TRANSPORTATION, WATER AND URBAN DEVELOPMENT DEPARTMENT  
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**PORT PERFORMANCE INDICATORS**

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*The operational performance of a port is generally measured in terms of the speed with which a vessel is despatched, the rate at which cargo is handled and the duration that cargo stays in port prior to shipment or post discharge. However, a progressive port manager would also wish to know how extensively and intensively its assets are being utilized as well as how well the operations perform financially. Indicators to measure these performances are determined generally in relation to the tonnage of shipping calling at the port and of the volume of cargo handled since port services in the main are rendered to ships and cargo. This note discusses the main indicators used by ports, and for ease of reference a tabulation is presented at the end of this note, which briefly describes how the indicators are determined.*

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**OPERATIONAL PERFORMANCE INDICATORS**

Primary measures of vessel performance are the ship turn-round time and the tonnage handled per ship day in port.

The ship turn-round time is the duration of the vessel's stay in port and is calculated from the time of arrival to the time of departure. Traditionally expressed in days, it is now common to express turn-round time in hours. The port authority would normally compile statistics that would provide monthly and annually average turn-round times. The average turn-round time per ship is determined by dividing the total hours by the total number of ships calling at the port.

In its basic form, ship turn-round time does not mean much, as the length of stay of a vessel is influenced by (a) the volume of cargo, (b) the facilities made available and (c) the composition of the cargo itself. Thus it becomes necessary for the port to break the basic ship turn-round time down for tankers, bulk carriers, container vessels and general cargo vessels, and even subdividing these into domestic trade, regional trade and ocean going vessels.

Since the duration of a vessel's stay in port is influenced by the volume of cargo that it works, a more useful measure of vessel performance is the tonnage handled per day or hour that the vessel is in port. The average tonnage handled per ship day or ship hour would be obtained by dividing the total tonnage of cargo that is loaded and discharged by the total number of hours that all vessels spend in port.

In compiling data that would enable the port to determine ship turn-round time or the tonnage handled per ship day (or ship hour), a port would normally split total time in port into time at berth and time off the berth and within each, the opportunity

would be taken to record for each service activity the amount of delay (idle time) as well as the reasons for the delay (e.g., waiting for cargo, opening/closing hatches, waiting for gears, rain, waiting for berth, etc). In particular, the ratio between the waiting time for berth and the time spent at berth, known as the waiting rate, is a significant indicator of possible congestion status.

While the tonnage handled per ship day (or hour) is a measure of the volume of cargo handled per unit of time of the vessel in port, productivity in ports is generally measured in terms of the tonnage of cargo handled per unit of work station per hour. In the case of general cargo, the work station is the gang, with containers, it is the crane (or hook). Thus productivity is measured in terms of (a) tons per gang hour for general cargo and (b) [TEUs](#)/per crane (or hook) hour. With tons per gang hour, the size of the gang is a material factor, as generally and up to a point, the larger the gang size the greater its output. Hence a more useful indicator of productivity for general cargo is the tonnage handled per man hour. In establishing the size of the gang, it should be noted that some ports have separate stevedoring and wharf gangs while some have an integrated gang that works on board vessels (stevedoring) as well as at the apron (wharfing). It should also be pointed out that very often the size and nature of the consignment has an influence on gang performance. Generally, the larger and more homogeneous the consignment the greater is the productivity.

The assessment of a port's performance from the point of view of the exporter/importer is quite basic in that there is only one indicator of interest, the dwell time of cargo in port measured in terms of the number of days that a ton of cargo remains in port. A high dwell time is generally an indication that all is not well with the port. It does not, however, identify areas where improvements may be sought since, unlike ship time in port, it does not have a breakdown according to the various procedures that have to be gone through before cargo can be shipped or delivered (e.g., customs clearance, waiting for instructions, waiting for ship, waiting for transport, etc.). The importance of dwell time also obviously varies with the nature of cargo.

## **ASSET PERFORMANCE**

Performance in asset utilization is measured in relation to the tonnage of ships calling at a port and/or the tonnage of cargo handled. Since the main assets of a port are its berths, it is important to measure the performance of the berths in terms of the throughput handled per berth. Berth throughput, therefore, is the total tonnage of cargo handled across a berth. Most ports obtain an average berth throughput by dividing the total tonnage handled at berths with the number of berths available at the port. A preferred method is to determine individually for each berth the total tonnage handled at the berth and then arrive at an average for all the berths. Throughput at berth is also measured in terms of tonnage handled per linear meter (or foot) of wharf.

The degree of utilization of a berth is measured by the berth utilization rate. This is the percentage of actual working time at the berth in relation to the time that the berth is occupied. This indicator seems more useful than the berth occupancy rate which measures the time that the berth is occupied relative to the total time that is available.

Like ship turn-round time, berth throughput is influenced largely by the class of commodity handled at the berth so that it becomes necessary to establish indicators that measure berth throughputs in the context of the class of cargo handled (general cargo, container, bulk, etc.).

## **FINANCIAL PERFORMANCE**

In addition to the financial performance that can be determined from the usual financial statements (income statement, profit and loss account, balance sheet), a port may wish to relate its income generation operating surpluses and expenditures to total [GRT/NRT](#) of shipping and the total tonnage of cargo handled at the port. Examples are income/expenditure per GRT (or NRT) of shipping and operating surplus per ton of cargo handled. The merit of relating income, expenditure and operating surplus to the tonnage of shipping or the tonnage of cargo handled is that a common denominator now exists for purpose of comparison.

Last but not least, a useful measure of financial performance is the rate of return on turnover which is determined by dividing

operating surplus by operating income. ([See Annex A](#)).

### **TO LEARN MORE**

UNCTAD. 1974. "Berth Throughput - Systematic Methods for Improving General Cargo Operations." Geneva.

UNCTAD. 1983. "Manual on a Uniform System of Port Statistics and Performance Indicators." Geneva.

UNCTAD. 1987. "Measuring and Evaluating Port Performance and Productivity." Geneva.

UN/ESCAP. 1985. "Portmis - Port Management Information System."

Plumlee, Carl H. 1982. "Port Performance Index."

Public Works Consultants.

"Information Requirements in Strategic Planning in the Ports Industry: Specification and Management of a Data Base." *Maritime Policy and Management*, Vol. 14, No. 1, 1987.

Hilling, David, "Port Efficiency and Capacity - Identifying the Bottlenecks." Bedford College, London.

Dr. Winkelmans. "Port Management and Free Market Economy Conditions: Goodbye to the Fiction of Effectiveness." Antwerpen University, Rotterdam.

"Container Handling Costs and Productivity Comparison."

*Ports and Harbors*, October 1992

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### **ENDNOTES**

1/ Twenty-foot Equivalent Unit (TEU): The basic unit for expressing the capacity to carry containers on cellular, part-container, or RoRo vessels. The purpose of this unit is to have a common denominator for ships designed to move containers of 20, 35, or 40 feet in length, with a standard width and height of eight feet. Capacity is also expressed in FEU (Forty-foot Equivalent Unit). [Back to text](#).

2/ Gross Registered Tons (GRT): The total of all the enclosed spaces within a ship, expressed in tons, each basis unit of which equals 100 cubic feet (2.831 cu.m). Net Registered Tonnage (NRT): The total of all the enclosed spaces within a ship available for cargo, expressed in tons, each basis unit of which equals 100 cubic feet (2.831 cu.m). [Back to text](#).

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#### **ANNEX A: PORT INDICATORS**

<b>Indicator</b>	<b>Basis of Computation</b>
1. Average ship turn-round time	Total hours vessel stay in port divided by

	Total no. of vessels
2. Average tonnage per vessel day (hour)	Total tonnage of cargo handled divided by Total no. of vessel days (hours)
3. Average vessel time at berth	Total hours alongside berths divided by Total no. of vessels berthed
4. Average vessel time outside	Total hours in port - total hours berth alongside divided by Total no. of vessel calls
5. Average waiting (idle) time	
a) for berth divided by	Total hours of vessels waiting for berth  Total no. of vessels berthed
b) due to rain divided by	Total hours of work stoppage due to rain  Total no. of vessels worked
c) other causes cause divided by	Total hours of stoppage attributed to the  Total no. of vessels worked
6. Average Waiting Rate (5a/3) divided by	Total hours of vessels waiting for berth  Total hours alongside berths
7. Tons per gang hour	Total tonnage handled divided by Total no. of gangs x total no. of hoursworked
8. TEUs per crane (hook) hour	Total no. of TEUs handled divided by Total no. of cranes used x total no. of hours cranes worked
9. Dwell time by	Total no. of cargo tons x days in port divided  Total tonnage of cargo handled
10. Berth throughput divided by	Total tonnage of cargo handled at berths  Total no. of berths
11. Throughput per linear meter divided by of wharf	Total tonnage of cargo handled at berths  Total length of berths
12. Berth occupancy rate (%)	Total time of ships at berths x 100 divided by Total no. of berths x 360 days

13. Berth utilization rate (%) divided by	Total time that ships actually work x 100  Total time of ships alongside
14. Income (expenditure) per GRT (or NRT) of shipping	Total income (expenditure)divided by Total GRT (or NRT) of shipping
15. Operating surplus per ton of cargo handled	Operating surplus divided by Total tonnage of cargo handled
16. Rate of return on turnover	Operating surplus divided by Operating income

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