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TRIPLE –E VESSELS: TONNAGE MEASUREMENT AND SUEZ CANAL DUES ASSESSMENT.

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ABSTRACT

Container is growing faster than GDP, Shipping lines always attempt to augment efficiency by reducing cost and by attracting larger volumes of containers. As a result rising container freight rates the lines have been driven to increase economic of scale, by building mega ships and fewer mere efficient port calls.

In 2011 Maersk line ordered up to 20 new "Triple- E "Class of container vessels delivers between 2013- 2015. These class of mega container vessels have its way through Suez Canal, other companies CMA, CGM also ordered this type of mega container vessels, in order to reach higher profits due to the achieved economics of scale It is believed that 20000 TEU could be the next target size.

Present mega container fleet and any future feasible potential vessel capacity expansion more than 18000 TEU put Suez Canal route in strong competitive position. Meanwhile Panama Canal will not be able to handle vessels larger than 12600 TEU even after its expansion in 2015.

Keywords*:* Triple – E Vessels – Tonnage measurement – Suez Canal rules.

INTRODUCTION

Various types of vessels transit Suez Canal , on top of these come container vessels, representing 56% of total Suez Canal net tonnages and 60% of Suez Canal total revenues.

Specifications and characteristics of Triple –E vessels have been studied .

It worth mentioning that Triple-E vessel pay about one million US dollar dues when transiting Suez Canal. At the same time the cost of TEU transiting Suez Canal for this type of container vessels are less than small types such as New –Panamax (12500 TEU) or New – Post Panamax (15000 TEU) ,thereby achieving economics of scale .

This paper mainly highlight various methods of tonnage measurement in general and Suez Canal in particular.

CONTAINER VESSELS EVOLUTION:

Container ships carry more than 95% of the world's manufactured goods.

In the last decades container vessels became larger carriers trying to achieve economies of scale by increasing the container vessels capacity and consequence the emergence of so called mega container vessels or ultra- large container vessels. This new generate of ships called: Triple-E has emerged taking into account its following specifications:

1. Energy efficiency.
2. Economics of scale and
3. Environmental improvements, reducing Co_2 emission by 50% per container carried.

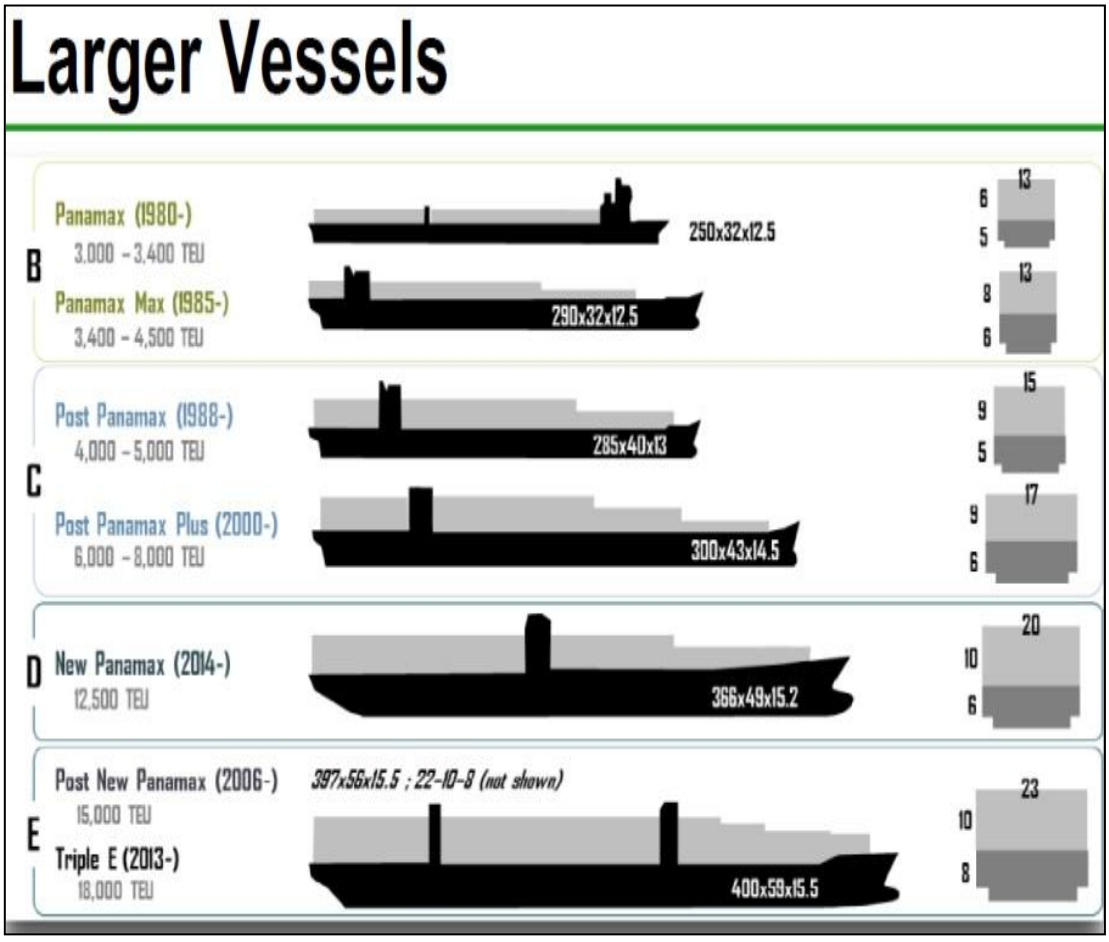


Figure No. (1) Evolution of Container ships

Figure No. (2) triple-class

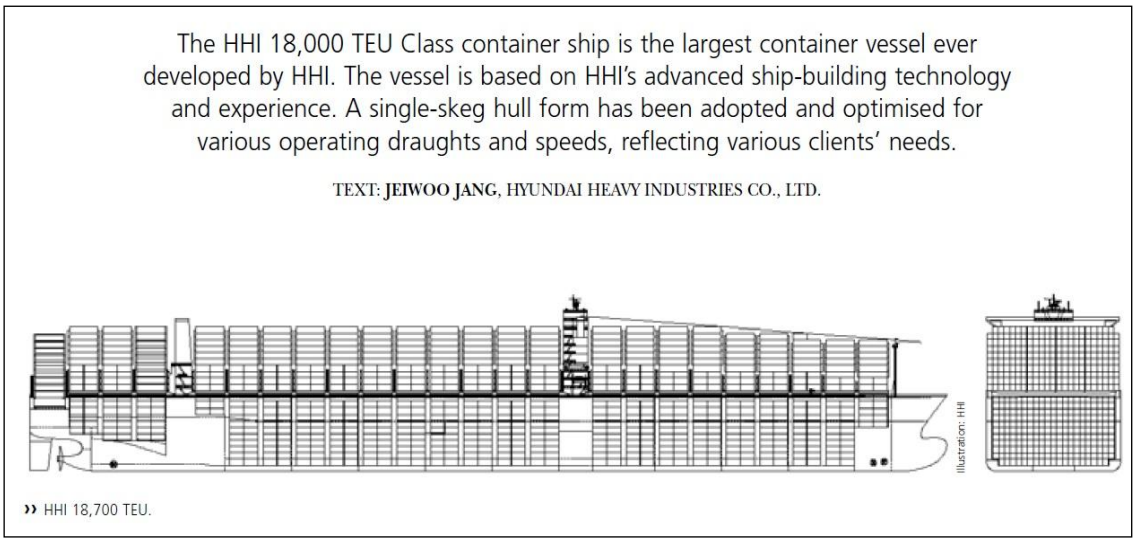
Such ships need new ports and container terminal with high specifications and sustainable maritime system. This type of vessels, nowadays use ASIA- Europe lane through Suez- Canal.

TRIPLE- E CLASS IN FIGURES

Length 400m width 59M Draught 14.5M capacity 18200 TEU (on deck approx. 10600 TEU in holds 7600 TEU) displacement 55000 tons, Reefer containers capacity 600 TEU. Height 73m.

Maximum speed 23 knots, average speed 17-18 knots. Rows in hold/ on hatches 21/23, Tiers in hold/ on Hatches 11/10.

Figure No .3 Container ship



Source, Ibid Figure No. (4)

Longitudinal Section of 18000 TEU Ship

The economics of ship size are the driving force for increasing numbers of containers transported. The dimensional aforementioned triple- E vessels are outside the ability of Panama Canal dimensions even after its recently expansion project.

Also it has 30% less power per tone displacement than the other vessels (EMMA MAERSK, MARCO POLO).

This is mainly because the triple- E will be sailing at the power speed because it has a more full body shaped U and more spacious than traditional containerships to accommodate one extra row of containers.

The engine room was put at the rear of the ship instead of the middle, so it is able to fit in more containers behind the navigation bridge and in the hull.

A waste heat recovery system helps propel the ship by capturing energy from the engine's exhaust gas. This cuts fuel by up to 10%. The, energy is also used to, among other things, produce electricity for the onboard accommodations the waste heat recovery system on Tripe – E has allowed to use a smaller and less energy- consuming main engine speeds in the range of 20- 25 knots, were commonplace 5 years ago, these speeds now had dropped to 15-17 knots.

PROBLEMS FACING TRIPLE- E VESSELS

The greater outreach required to service the ship's extra row of containers will mean longer booms. The boom also must be located at a greater height because of the height of the ship's container stacks which also creates number of a new stress.

The wind forces on the crane will be higher which has an impact on wheel loads [(1)].

The capital cost per TEU moved has increased even considering the increase in slot size of the vessels. Furthermore, due to the increase in transportation duration, the capital cost and insurance of goods transported have gone up.

Furthermore the cost increase could be accounted for the increase in time to market fast moving goods that need longer to get from the world's production centers to the markets is also a cost.

Shipping lines are demanding ever shorter port stay in order to make the economies of scale work. Longer vessels of 400 yards (such as Maersk Line's Triple- E class) will lead to more berth wastage, to handle 18000 TEU efficiently, high port productivity and reliability are essential to enable carriers to operate will there schedules.

The bigger the ship, the greater the cost of hours lost in port, and an increased port stay is a diseconomy of scale [(2)].

IMPORTANCE OF CONTAINER SHIPS IN SUEZ CANAL

The Suez Canal plays a pivotal role in today's global container shipping network in particularly in accommodating vessels sailing on the important. ASIA- EUROPE trade lane.

Container ships accounted for about 56% of Suez Canal total net tonnages and60% of total revenues. The chare of containerized cargo also is still rising. The number of TEUs transiting the Suez Canal are still growing , it has reached (42.1 million TEUs) in 2014 ,(38.2 million TEUs) in 2013 and (37.7 million TEUs) in2012 .The following data illustrates the importance of container vessels traffic through Suez Canal (as stated on tables 1 & 2).

Table No.(1) Number of container ships and its net tonnages (2010- 2014)

Year	No. of Container vessels	Container ships net tonnages (million tons)	Total net tonnages of ships in Suez Canal (Million Tons)	Ratio of net tonnage of container ships%
2010	6852	465.7	846.4	55
2011	7178	519.3	928.5	55.9
2012	6332	507.1	928.5	54.6
2013	6014	508.2	915.5	55.5
2014	6129	536.3	962.7	55.7

Source: Suez Canal Authority

***Table No.(2) Containerized Cargo in Suez Canal(2010- 2014)**

Year	Containerized cargo (million tons)	Total Cargo (Million Tons)	Ratio of containerized Cargo %
2010	367.0	646.1	56.8
2011	397.2	691.8	57.4
2012	398.0	739.9	53.8

2013	406.1	754.5	53.8
2014	435.0	822.3	52.9

Source: Suez Canal Authority

Comparing containerized cargo with the total cargo in Suez Canal, we find it ranges between 54% to 57% as stated in table 2.

IMPORTANCE OF TONNAGE IN MARITIME WORLD:

Maritime institutes and departments of ship engineering in Egyptian Universities does not give sufficient importance to the study of ships tonnage measurement rules in spite its importance in maritime world.

The tonnage of a ship has become important one of its defining characteristics.

This paper is intended to define briefly and in general way point out some of the ways that tonnage factors influence ship design, also its influence on the financial operations of ship-owners who pay dues in accordance with the amount of net tonnage or grass tonnage or net register tonnage.

Practically all seagoing merchant vessels operating on the open seas, bays, rivers, lakes and waterways are measured for the assignment of national gross and net registered tonnages. Also vessels intending to transit Suez Canal and Panama are measured according to the rules of the respective canal authorities.

IMO rules, refer always to tonnage base to its laws. Harbors and waterways dues are depending on net tonnage base or gross tonnage.

Light house dues, pilotage dues, dry dock dues wharves and similar facilities throughout the life of the vessel depends on its tonnage.

Also there is a correlation between tonnage and the balance of the ships and the rules of ship's safety.

The tonnage figures are used also for statistics in maritime trade of for charging taxes. Also used for comparison of national fleets, framing of policies on trade of shipping, granting of subsidies, comparison of shipbuilding, scrapping, regulatory application basis for manning, registration and survey charges, insurance premium and limitation liability in cases of pollution.

For vessel registration tonnage indicator must be offered.

Shipping tonnages was a useful indicator of a country's commercial strength, also indicating physical carrying capacity of ship and comparison of trade and movement of goods.

Tonnage for centuries has been used to indicate the relative magnitude of ships.

EVOLUTION OF TONNAGE MEASUREMENT SYSTEM:

Moorsom's system 1854:

Traditionally tonnage was related to the carrying capacity of the ship. Moorsom's[5] concept related tonnage to the total volume of enclosed spaces. Being the colonial power, the British maritime legislation spread throughout the world.
During the second halve of the 19th century, Moorsom's system was the basis for tonnage measurement around the world, though the rules varied from one jurisdiction to another[6].

Suez Canal Rules 1873(7):

Initially the net register tonnage was used as a basis for Suez Canal Company tolls. Since the revenue of Suez Canal was inadequate to meet the expenses and owing to the questionable propelling power deduction for steamers, gross register tonnage was adapted as the basis from July 1872, leading to a higher charges. Shipping companies and owners opposed this change. Thus an international tonnage commission, formed to resolve the issue, adopted separate rules for Suez Canal tonnage in
1873 at Constantinople. It was expected that the 1873 rules would be adopted by the countries represented at Constantinople leading to a universal system. Separate rules for Suez Canal tonnage came into existence.
It is important here to cite the text of Annex 2 regulation for the measurement of tonnage recommended by the international tonnage commission assembled at Constantinople 1873:
"General principles: The gross tonnage or total capacity of ships comprises the exact measurement of all spaces (without any exception) below the upper deck, as well as of all permanent covered and closed- in erections on that deck".
N. B. by permanent covered and closed- in erections on the upper deck are to be understood all those which are separated off by decks or coverings, or fixed partitions and therefore represent an increase of capacity which might be used for the stowage of merchandises, or for the berthing and accommodation of the passengers or of officers and crew…[8].
This text in the Constantinople convention is the philosophical basis for estimating the Suez Canal tonnage so far.

Panama Canal Ad measurement system:

The tonnage measurement system used in the Panama Canal is known as: Panama Canal Universal measurement system (PC/UMS), following the rules of ITC- 1969, using its parameters to determine the total volume of a vessel with the additional variations established by the authority.
The ACP admeasurement system for a full container vessels reflects the international standard for a container TEU. This measurement considers the full container carrying capacity of vessels (above and below deck).

In October 2002, the Panama Canal Authority decided to charge container vessels under in new method based on TEU, since the PC/UMS net tonnage was not representing the earning or economic capacity of container vessels(9).

International convention on Tonnage Measurement of ships, 1969 (ITC- 69):

The efforts for a uniform method materialized when the convention on tonnage measurement of ships (ITC- 69) was adopted at an international conference held in London from 27th May to 23 June 1969. It was the second successful attempt to introduce a universal tonnage measurement system. The first attempt in 1873, when the Maritime powers assembled at Constantinople and adopted the rules of Suez Canal measurement system.
ITC- 69 applies to ships above 24 meters length and came into force on 18th July 1982. A phase in period was given for the ships built before that date to retain the existing tonnage figures up to 18th July 1994, for a smooth transition to the new system.
The Suez Canal and Panama Canal Company continued with their separate methods for tonnage measurement even after adopting (ITC- 69) 150 states amounting to 98.9% of world tonnage have ratified the convention, as of 31th July 2010(10).
Under ITC-69 the overall size and useful capacity of a ship are indicated by dimensionless figures, GT and NT respectively (instead of GRT and NRT under Moorson's system).
Calculated based on the total molded volume of enclosed spaces and volume of cargo spaces(11).

THEREFORE

GT= K,1 V, whereby V= Total Volume of all enclosed spaces in cubic meters, and K1= a coefficient as tabulated in appendix 2 (of the convention). This coefficient ranges from 0.22 to 0.32 for the smallest to the largest volumes and cares for results being similar to the former tonnage figures based on 100 cubic feet.

For the calculation of NT, same coefficient is used together with the volume of cargo spaces, the depth and the draught. NT shall not be taken as less than 0.30 GT. Thus GT and NT are calculated independently(12).

SUEZ CANAL TRANSIT FEES OF TRIPLE-E VESSELS:

The tonnage on which all dues and charges to be paid by vessels are assessed, is the net tonnage resulting from the system of measurement laid down by the international commission held in Constantinople in 1873, and duly entered, on the special tonnage certificate issued by the competent authorities in each country(13).

The containers on upper deck are considered as closed in spaces increasing the carriage capacity of the ship when situated over the main deck(14).

Tolls are calculated on the basis of Suez Canal net tonnage plus a Ratio specified for the number of tiers on the upper deck according to circular No. 3/2014 of Suez Canal are as follows:

Northbound Container Vessels:

4% for vessels carrying one tier.
6% for vessels carrying two tiers.
8% for vessels carrying three tiers.
11% for vessels carrying four tiers.
15% for vessels carrying five tiers.
21% for vessels carrying six tiers.

An increase of 2% shall be applied for each tier in excess of six tiers, which means that a surcharge of 23% shall be applied on vessels carrying seven tiers and 25% surcharge if vessels carrying 8 tiers…etc.:

South bound vessels, circular No. 2/2007 shall remain in force, for example container vessel carrying 8 tiers on deck shall pay 20% surcharge[(15)].

Southbound container vessel:

2% for vessels carrying one tier.
4% for vessels carrying two tiers.
6% for vessels carrying three tiers.
8% for vessels carrying four tiers.
12% for vessels carrying five tiers.
16% for vessels carrying Six tiers.
18% for vessels carrying Seven tiers.

An increase of 2% shall be applied for each tier in excess of seven tiers, which means that a surcharge of 20% shall be applied on vessels carrying 8 tiers on deck….etc.

Example:

Northbound transit

Triple– E class transited the Canal from Suez its gross tonnage= 200532 tons.
Net tonnage= 180528 tons. Carrying 8 layers of containers on upper deck.
So additional dues 25% are taxed, plus extra dues for escorting tugs and pilots.
The total Canal dues were 932741 U.S $. That means the transfer cost of TEU in Suez Canal is 64.4 U.S. $. So the more TEU the ship carry the less cost are realized. Another triple- E class vessel's cost of TEU through the Suez Canal is 58.8 U.S $.

Southbound Transit

Cost of TEU transiting Suez Canal ranges between 56 and 59 U.S $, according to the number containers the ship were transporting.

EMMA- MAERSK class vessel

This type of container vessel capacity 15000 TEU, the cost of TEU for transiting Suez Canal was 71.8 U.S. $ in case of 68% utilization.

Table (3) TEU fees in Suez Canal

TEU Cost U.S. $.	Utilization
a- *Triple- E Direction (Northbound):*	
67.5	76.0%
64.5	80.4%
58.8	88.9%
b- *Triple- E Direction (Southbound):*	
56.1	88.4%
55.1	86.0%
58.5	85.0%
c- *Emma Maersk Class (Southbound):*	
71.8	68.0%

TEU transport Cost through Suez Canal decrease, the higher the numbers of TEU can the ship carry.

ADVANTAGES GRANTED TO CONTAINER VESSELS

- Allow to the vessel carrying 10 TEUs on the higher tier without calculating it as tier.
- If protuberance part of open TEUs on the last tier exceeds half height of container, then consider one tier.
- If the ship carry empty containers only, then Suez Canal dues shall be calculated as ballast, provided that:
- Containers carried belongs to the owner or charters.

CONCLUSIONS

- Container vessels represent the bulk of the Suez Canal revenues.
- There is correlation between mega projects and economics of scale.
- Varying utilization of mega container ship affect the cost of TEU transiting Suez Canal.
- The slot cost increase for diminishing utilization.
- The importance of tonnage measurement of container ship in particular for its operating economics.
- The need to pay attention to the rules of tonnage measurement of ships in the maritime institutes and colleges of engineering (Departments of ship engineering).
- New Suez Canal will cut time of transiting, consequently affecting Triple- E economics by saving time.

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