TRANSNAV
http://www.transnav.eu
the International Journal
on Marine Navigation
and Safety of Sea Transportation
Volume 13
Number 3
September 2019
DOI: 10.12716/1001.13.03.07

The Impact of the New Panama Canal on Cost-savings in the Shipping Industry

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ABSTRACT: The passage through the Panama Canal has become the usual waterway for all the ships that can navigate through the Canal. The traffic through the canal is limited by the size of a ship. The need for the expansion of the Canal has emerged due to the development of the global trade and the shipping industry. The new dimensions of the lock-chambers determine the size of the ships as well. The new generation of ships built to the largest specifications possible to transit the current locks of the canal are called the Post-Panamax vessels. The maximum dimensions of these ships are 366 meters in length, 49 meters in beam and 15.2 metres in draught. The paper analyses savings in the operational costs on three types of the Post-Panamax vessels after the Canal expansion.

1 INTRODUCTION

The construction of the Canal, which lasted for 34 years, introduced the shorter and more efficient route between the east and west coasts of the United States of America. The Panama Canal connects the Atlantic and Pacific oceans through the narrow Isthmus of Panama. Thus, the circumnavigation of the South America was avoided and the route was shortened by 12.875 kilometres. The Panama Canal is situated in Panama, and is under the sovereignty and control of the Republic of Panama. The Canal operates using a system of locks that raise ships from sea level. Technology development in the shipping industry resulted in the construction of the Post-Panamax vessels, which due to their size were not able to navigate through the system of locks. The arising problems of transit and navigating through the area catapulted into the limelight the "third set of locks project," which was put to vote and approved in the national referendum.

The construction of the new and expanded canal enabled the passage of the Post-Panamax ships. The navigation of this category became a standard in the maritime industry and proved the Canal to be of great importance to the world shipping. The launch of the new Panama Canal, allowed this category of ships to experience great financial benefits and savings in their operational costs. This paper analyses several world ports comparing the costs of navigation through the Canal and those using the surrounding routes. The analysis has identified savings in all categories of ships and routes analysed.

2 THE NEW PANAMA CANAL

The decision to expand the Panama Canal was necessary, mainly because it was estimated that the Canal would reach its maximum capacity in between 2009 and 2012. In addition, at the time 37% of the world's container fleet could not fit the Canal due to

their size. Therefore, Martin Torrijos, the president at the time, proposed the Canal expansion project, which was ultimately approved by three quarters of the Panamanian voters in a national referendum.

The project of reconstruction started in 2008. The total costs had been estimated to 7 billion US dollars. However, the investors had hoped to return the investment costs by 3.5% cost raising through the following two decades. The expansion works were carried out in four phases, and required the excavation of more than 150 million cubic metres of material and 5.5 million cubic metres of concrete. Both ocean-entrances were deepened, the new locks constructed, Gatun lake entrance was widened and the new access channel built thus bypassing Miraflores Lake.

The Pacific side works started on 1st April 2008. The work entrance consisted of widening the navigation channel on the Pacific entrance to 225 meters (from the existing 195 metres) and deepening it to 15.5 meters. The dredging up of 8.7 million cubic metres of dirt was executed.

The Atlantic side works started on 25th September 2009 by dredging of seabed and excavating the new entrance. Deepening of Lake Gatun resulted in rising of the water level by 45 centimetres and increase of the reservoir capacity by 200 million cubic metres of water.

The work on the third set was most expensive with 3.2 billion dollar worth part of the project enabled the passage of Neopanamax ships through the Canal.

The Project included the design and construction of two similar lock complexes, one on the Pacific and the other on the Atlantic side. Each complex has three chambers and uses nine water-saving basins. The construction of new locks required the construction of new system of the chamber gates. Instead of the existing swing doors, the system of rolling gates was designed and implemented. New chambers are 427 long and 55 metres wide, and can accommodate ships up to 366 metres long. The chambers are 18.3 metres deep and the maximum allowed draught is 15.2 metres.

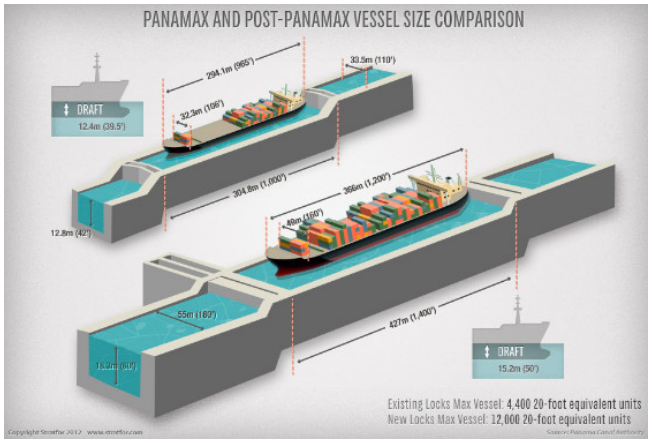


Figure 1. Comparison of the existing locks and new locks (*http://www.longshoreshippingnews.com/2015/08/maersks-newbuilds-wont-fit-new-panama-canal/* downloaded on 25 May 2018)

3 PANAMAX AND NEW PANAMAX VESSELS

Panamax is a term used for maximum size of ships that can fit through the Panama Canal locks. The sizes of Panamax ships are determined by considering the dimensions of the smallest lock of the canal. The Panamax vessels can be up to 294 metres long, 32 metres wide and with the draught of 12.56 metres. Development in technology and larger demands in the maritime shipping resulted in a new design and construction of ships, which could not fit the Panama Canal. Those ships are known as Post-Panamax or New Panamax vessels.

The construction of new, larger set of locks has resulted in the construction of larger ships called New Panamax vessels. The loading capacity of the ships has increased from 5000 TEU to 14000 TEU. The expanded Canal is 366 meters long, 49 meters wide, with 15.2 metres draught.

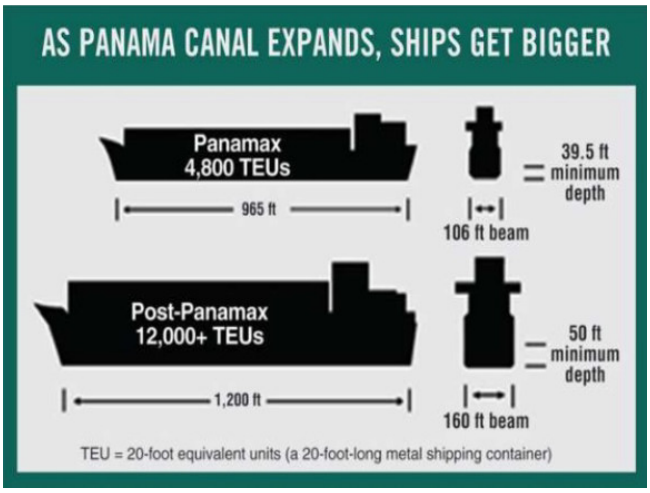


Figure 2. Panamax and Post-Panamax vessel size comparison (http://yachtpals.com/cruising/panama downloaded on 24 May 2108)

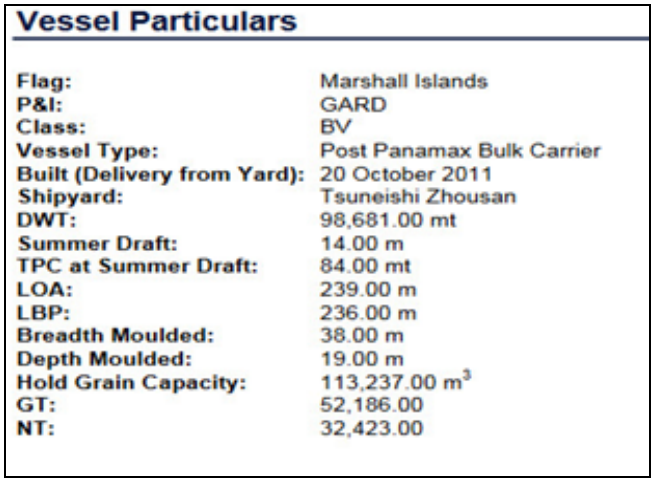
4 THE PANAMA CANAL TRANSIT TOLL TARIFFS

All vessels have to pay the certain toll in order to pass through the Canal. Tolls are calculated according to ship measurement parameters. The size of a ship is determined by her type. This paper analyses 3 types of ships:

- Bulk carriers,
- Container vessels, and
- Tankers.

Dry bulk vessel tolls are based on a deadweight tonnage and metric tons of cargo. Types of bulk cargo carriers are classified into four categories: grain carriers, coal carriers, iron ore carriers and all other types of dry bulk cargo carriers.

This paper analyses transit tolls for the ship that has characteristics listed in Figure 3. For the purposes of the company and ship protection data the paper will refer to this ship as BULK CARRIER 1.



Vessel Particulars

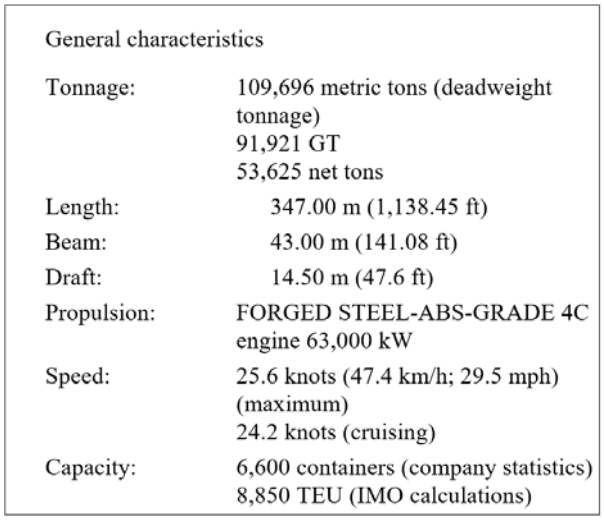
Flag:	Marshall Islands
P&I:	GARD
Class:	BV
Vessel Type:	Post Panamax Bulk Carrier
Built (Delivery from Yard):	20 October 2011
Shipyard:	Tsuneishi Zhousan
DWT:	98,681.00 mt
Summer Draft:	14.00 m
TPC at Summer Draft:	84.00 mt
LOA:	239.00 m
LBP:	236.00 m
Breadth Moulded:	38.00 m
Depth Moulded:	19.00 m
Hold Grain Capacity:	113,237.00 m^3
GT:	52,186.00
NT:	32,423.00

Figure 3. BULK CARRIER 1 particulars

Taking into consideration the size of the ship and the tolls for this category of ship it has been calculated that the overall transit price through the New Panama Canal for BULK CARRIER 1 totals 200,215 $ (fully laden grain carrier).

The Canal transit costs for container vessels are calculated according to number of container on board. The cargo carrying capacity of container vessels is expressed in TEU (twenty-foot equivalent unit), the unit of the capacity of a container ship. The toll tariff depends on the fact whether the vessels transport fully loaded containers or empty containers.

This paper analyses transit tolls for the container ship that has characteristics listed in Figure 4. For the purposes of the company and ship protection data the paper will refer to this ship as CONTAINER 1.



General characteristics

Tonnage:	109,696 metric tons (deadweight tonnage) 91,921 GT 53,625 net tons
Length:	347.00 m (1,138.45 ft)
Beam:	43.00 m (141.08 ft)
Draft:	14.50 m (47.6 ft)
Propulsion:	FORGED STEEL-ABS-GRADE 4C engine 63,000 kW
Speed:	25.6 knots (47.4 km/h; 29.5 mph) (maximum) 24.2 knots (cruising)
Capacity:	6,600 containers (company statistics) 8,850 TEU (IMO calculations)

Figure 4. CONTAINER 1 particulars

Taking into consideration the size of the vessel and the tolls for this category of vessel it has been calculated that the overall transit price through the New Panama Canal for CONTAINER 1 totals 354,000 $.

Tanker tolls are be based and priced on deadweight tonnage capacity of tankers expressed in metric tons. Apart from tonnage capacity, two other factors are taken into consideration: whether the vessel is fully loaded or operates without cargo (in ballast condition). For the purposes of the company and ship protection data the paper will refer to this ship as TANKER 1 (Figure 5).

Shipyard:	Brodosplit, Croatia
Class:	BV
IMO number:	9334739
Dimensions:	
L.O.A.:	247,4 m
Summer draft:	42,04 m
KTM:	54,19 m
BCM:	121, 99
Load line / tonnages	
SDWT:	108.433,00 T
GT:	59.315,00
NT:	34.574,00
TPC:	94,00 T
Suez Net:	52.809,00
Light Ship:	18.834,00 T
Cargo capacity:	At 98% (inc. slops): 123.686 m^3
No. of segregations:	3
S.B.T./I.G.S./C. O.W:	Yes/Yes/Yes
Vapour Emission Control System:	Yes
Hose Handling Equipment:	Crane 2x 15 T SWL

Figure 5. TANKER 1 particulars

Taking into consideration the size of the ship and the tolls for this category of ship we have calculated that the overall transit price through the New Panama Canal for TANKER 1 totals 455,450 $ (fully laden crude oil tanker)

5 CALCULATIONS AND COST SAVINGS UPON OPENING OF THE EXPANDED PANAMA CANAL

The fifth chapter compares the price of tolls for three different types of ship with expenses of circumnavigation of the South America. In order to prove whether there are any savings in the operation of ships travelling through the Canal, randomly selected ports were selected for the purpose of the analysis (listed in Table 1).

The table shows the difference of more than 5000 nautical miles on three navigational routes analysed. Such a difference in distance may be regarded as a prolongation of navigation between the port of departure and the port of destination in days or hours of navigation.

Table 1. Route options between analysed ports

	Port of departure	Port of destination	Distance (M)	Distance through panama canal (M)	Distance difference (M)
1	San Francisco	Antwerp	13789	7781	6008
2	Los Angeles	Gibraltar	12609	7314	5295
3	San Pedro	Houston	9649	3851	6798

Different speed in different type of vessels has resulted in difference in time. Since the bulk carriers are the slowest ones among the analysed ships, the navigation can be longer for more than 20 days, if not passing through the Panama Canal.

Table 5. Calculation of cost savings by navigation through the Panama Canal

Vessel		Fuel cost ($)	Ship's daily costs	The Panama Canal transit cost ($)	Savings ($)	Savings (%)
Route 1	Bulk carrier 1	477,312	288,000	200,215	565,097	73.84
Route 2		420,134	253,500	200,215	473,419	70.28
Route 3		539,462	325,500	200,215	664,747	76.85
Route 1	Container 1	1,033,543	195,700	354,000	875,243	71.20
Route 2		913,130	172,900	354,000	732,030	67.40
Route 3		1,174,024	222,300	354,000	1,042,324	74.65
Route 1	Tanker 1	418,371	356,000	455,450	318,921	41.18
Route 2		369,012	314,000	455,450	227,562	33.32
Route 3		474,780	404,000	455,450	423,330	48.17

The prolongation of the voyage for one or more days can be analysed through the operational costs of the ship. Daily costs can be divided and evaluated in two parts:
– daily charter cost,
– daily fuel and lubricating oil costs.

Data on daily charter costs can be tracked on the shipping stock markets. For the purposes of this paper, the navigation data on 20th June 2018 were analysed.

The daily fuel consumption depends on the ship's specifications. The following table displays calculation of the fuel consumption for the vessels analysed in this paper.

Table 2. Analysed vessels daily costs

Type of vessel	Speed (kn)	Daily distance (M)	Daily fuel consumption	Daily charter
			(tons)	costs ($)
Bulk carrier	13	312	55	15,000
Container 1	24.2	580.8	222	19,000
Tanker 1	15	336	52	20,000

As far as speed and consumption are concerned container vessels particularly stand out. As a part of door-to-door shipping technology, they base their services on fast delivery of goods. They have such a design and construction, which allows them to reach speeds almost twice as those of other two types of ships analysed. Hereupon, the paper analyses bunker costs by multiplying daily fuel consumption and its price on 20th June 2018. These data are listed in Table 3.

Table 3. Total fuel costs per analysed route option

Type of vessel	Route 1/fuel consumption	Route 2/fuel consumption	Route 3/fuel consumption
	costs ($)	costs ($)	costs ($)
Bulk carrier	477,312	420,134	539,462
Container 1	1,033,543	913,130	1,174,024
Tanker 1	418,371	369,012	474,780

Apart from fuel consumption costs, the following table specifies daily charter costs for the type of vessels analyzed in this paper (Table 4).

Table 4. Daily charterer costs per vessel

Type of vessel	Route 1 – daily cost	Route 2 – daily cost	Route 3 – daily cos
Bulk carrier	288,000 ($)	253,500 ($)	325,500 ($)
Container 1	195,700 ($)	172,900 ($)	222,300 ($)
Tanker 1	356,000 ($)	314,000 ($)	404,000 ($)

After calculating time needed if the Panama Canal is not used, bunker and daily charter costs, we have come upon certain numbers that approximately represent operational costs for the ports analysed. These costs have been compared to the Panama Canal transit costs (Table 5).

The data in table 5 have demonstrated that the smallest cost-savings if passing through the Panama Canal are 227,562 US dollars, which is extremely large sum of money. The maximum cost-savings of the ships analyzed are 1,042,342 US dollars.

6 CONCLUSION

The Panama Canal is the busiest waterway connecting the Pacific and Atlantic oceans. Since its opening, the number of transits has been the indicator of its great importance for the global shipping. The old dimensions of the First Panama Canal could not suit the needs of the modern shipping industry. The locks became too small despite the development of the new generation of ships. Therefore, the global shipping industry was hindered by the inability of ships to pass through this important traffic route. The problem of the Post-Panamax vessel-transit was solved by opening of the New Panama Canal in 2015. The paper has analysed three categories of ships of this type on three different traffic routes. The analysis has shown cost-savings for all three types of vessels analysed. The savings range from 33-76%. If we convert this percentage into US dollars, the savings range from 227,562 to 1,042,324 US dollars. Hence, it can be concluded that the opening of the New Panama Canal has resulted in savings in all analysed types of ships and that these saving can amount to millions of dollars for certain categories of ships.

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