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Aspects concerning the modernization of the Panama Canal in the context of the optimization of the maritime transport services

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Abstract. In the context of the modernisation of the Panama Canal I considered important to conduct a study on its consequences in the optimisation of maritime transport services.It is presented a comparative analysis from the point of view of the new technical specifications and rules of sailing, the new taxes to transit the channel as well as the important from the point of view of the decreasing the shipping routes.
Keywords: Panama Canal, rules of sailing, maritime transport, taxes to transit the channel, vessel.

1. Introduction

The idea of building the Panama Canal came in the sixteenth century and the actual construction was completed after the works were taken over by the USA, the inauguration taking place in 1914 [1]

The Panama Channel connects the Pacific Ocean and Atlantic Ocean and is a highly important route in maritime transport for over 100 years, ensuring fluidization in worldwide maritime transport. The Channel is divided in five sectors, respectively, the first one stretches from the defending piers situated in Limon, owned by the Atlantic Ocean until the Gatun Lake. Here, the first set of locks named Gatun Locks are found. Followed by, the second sector is found comprised between the exits from Gatun Locks to the entrance of Culebra massif. The third sector is named Gaillard Sailing Line in which the minimum width is 300 meters and the water depth is 90 meters.

By the utilization of Pedro Miguel locks, descends from the level of Miraflores Lake, to the fourth sector reaching on the navigable channel called Rio Grande at the level of Pacific Ocean waters. The last sector starts at the entrance of the Rio Grande navigable channel and it ends near the Balboa Port located in the area of Panama City.

The Panama Channel is equipped with the biggest locks in the world, ensuring a difference in level of 26 meters between the Atlantic Ocean and Pacific Ocean. Going into bankruptcy, the French company who started the construction of the Canal in 1880 gave away the mission to continue the work to another company who registered another failure in 1900 as a result of illnesses who affected the area, and also the financial struggles they would later face. In 1903 when Panama broke up from Colombia, a treaty was signed with the United States of America by which they gave up a piece of its territory, measuring 50 Mm in length and 10 Mm in width, who became Panamanian territory starting with 1st of October 1979, but USA kept the role of the administrator of the Canal.[1]

Over the years, due to the evolution of shipbuilding, the modernization of the Channel has been imposed to allow the transit of new ships called Neo-Panamax with daily flow optimisation through

the Canal, at the same time the necessity to increase vessels through it was also due to the transformation suffered by the Suez Canal. The project was proposed in 2006 and aimed at doubling the capacity of the Channel by adding a new traffic line and also raising the number of vessels with superior dimensions who can transit through it.

The expansion of the Panama Channel has begun in September 2007 and was finished in May 2016.

Panama Canal [2]

2. The evolution of the Panama Canal

The Panama Channel stretches over an approximate length of 80 kilometres including five major sectors, in the northern part there is the Cristobal Port situated at the Atlantic Ocean and at the southern side the Balboa port, belonging to the Pacific Ocean.

The width of the Panama Channel is between 91 and 300 meters and the minimum depth is 12.5 meters. The daily number of lockage reaches up to 48meters.

Before the modernization, south to the Cristobal Port, the ships which arrived could be lifted up to the level of Gatun Lake with help from the first set of locks. The dimensions of Gatun locks were, 3048,8 meters in length and 35,55 meters in width, imposing the vessels maximum lengths of 294,1 meters, and a maximum width of 32,3 meters, and also the draft in freshwater did not have to exceed 12 meters.[1]

Gatun Lake of whose length exceeds the average length of the Canal was created by the impoundment of Chagres River and was used for anchoring of ships and fluidizing the traffic on both ways, in a climate of tropical jungle

No other criterion is as important as the time economy, optimizing the maritime transport by shortening the waterways and the much faster delivery of freight, concurrently with the reduction of fuel costs.

2.1 Particularities of the new set of locks and implications in the evolution of shipbuilding

The new set of locks are located, one on the Atlantic Ocean side called Agua Clara, and the other one on the Pacific side called Cocoli. Both are adjacent to already existing locks. They are made from reinforced concrete, and have lengths over a mile and a half each, the chambers have 427 meters in length, 18 meters depth and 55 meters width. They are equipped with Miter locking gates which include pivot spaces that allow a ship to accommodate and protect when opening and closing.

New set of Panama Canal locks [3],[4]

Each set of locks has wing-type walls, locking heads, water-saving basins, valve gates, electrical systems, control systems and mechanical systems required for operation and maintenance. This locking system allows a fully operational transit for Post Panamax vessels in both navigation directions.

Regarding the constructive evolution of ships that transited the Panama Channel, the Panamax type ships are more noticed, having 294,13 meters in length, widths of 32,31 meters, a draft of 12,04 meters, followed by New Panamax type ships with lengths of 366 meters, 49 meters in width and draft of 15,2 meters and last but not least the Post Panamax ships with 385,6 meters in length, a width of 53,9 meters and a draft of 15,2 meters.[1]

2.2Aspects concerning the modernization of Panama Canal in the context of maritime transport services.

The aim of modernizing the Panama Canal was to expand the capacity of the channel, to develop the maritime transport and to diversify its commercial business activities.

With the changes to the Panama Canal, in order to allow the transit of the Neopanamax ships, the ports in the United States had to adapt to the new dimensional characteristics of the ships that are now in transit. Thus, most of the large harbors in the United States of America, especially those on the East Coast, have engaged in dredging to increase the depth of waterways and to be able to operate larger-scale vessels up to 15- 16 meters. They also had to modernize their port infrastructure and increase the terminal operating capability to handle a much larger number of containers simultaneously with the new dimensions of the channel locks.

In the context of globalization and spectacular development of vessels transport capacity, the implementation of new constructive solutions for the Panama Canal led to an impressive growth of freight traffic simultaneously with reducing the waiting time for transiting the canal and applying new safety rules. It is noted that approximately 65% of ships with the biggest dimensions are annually transiting the canal optimising over 200 worldwide maritime routes.

Reducing the CO2 pollution in the context of maritime transport was implemented by the Authority of Panama Canal by utilizing a type of software that generates gas emissions depending on the type of vessel and on the particularities of the ware that is being transported.

Mega yachts are transiting the Panama Canal for over 20 years.

Regarding the traffic restrictions through the Panama Channel, these are determined by the technical characteristics of ships, as well as the type of freight transported. Large ships must pay additional charges that include possible risks. Such vessels are container ships, passenger ships, vehicle carriers, LPG and LNG ships.

Also, from the category of traffic restrictions, those in relation with canal transit at day-time and night-time or by the period of the year when the transit takes place, can also be exemplified.

3. The comparative analysis of wares traffic through the Panama Canal.

The transit fee for the Panama Canal is calculated according to the ship’s type and size, as well as the transported wares.

In the following, the comparative analysis for the period of 2015-2018 of the traffic of ships that transited the Panama Canal is presented.

In the year of 2016, once with the extension of the Panama Canal, the maritime traffic of ships that transited it, tripled. Compared to the year of 2015 the transit of ships through the Canal recorded an increase by 5.5% over the previous year. It is noted that 50% of the total collected fees for the channel transit has come from container ships, which means an approximately 2.9% traffic of this type of vessel.

LPG and LNG vessels that transited the Canal were approximately 7%. Bulkers that transited the area were approximately 18.4% more than the previous year. The total number of ships recorded through the Panama Canal in 2016 was 11,684. [6]

Taking into account the type of goods that transited the channel will be illustrated, in table 1, expressed in long tones, a comparative analysis for the years 2015 and 2016.
These are drawn in figure 1.

Wares	Petroleum	Grains	Chemicals	Nitrates	Refrigerated	Container	Coal	Ores	Steel	Others
2015	41,3	53	14,2	7,1	3,1	41	10,2	14,3	6,1	2,6
2016	41,8	41,5	16,7	7,4	2,7	41,4	8,2	11,3	5,3	4,3

Table 1

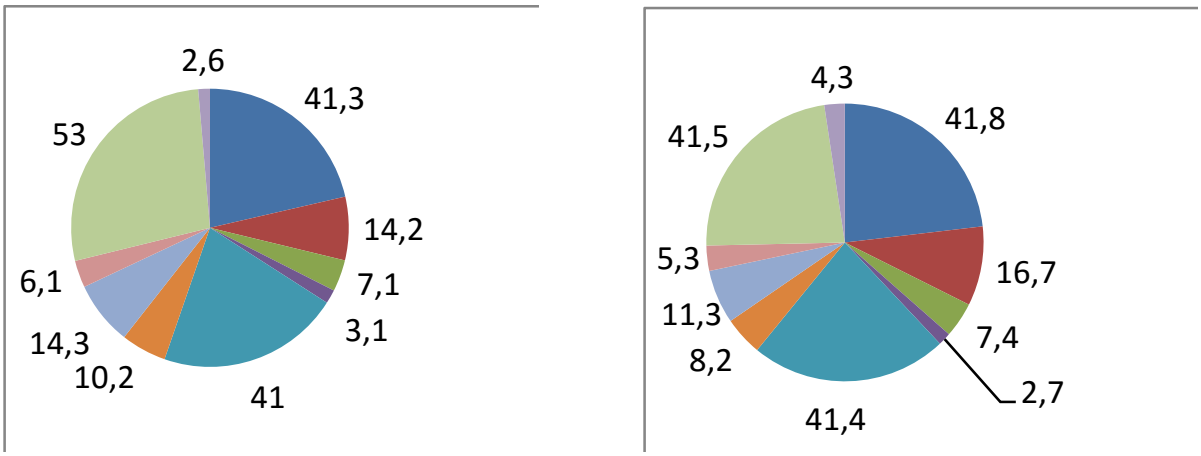

Figure 1

In 2017 it was found an increase by 3.3% of ships who transited the Canal compared to the previous year. Of these, only ships using routes from the ports of East Coast of USA and ports belonging to Asia, or Central America have recorded a percent of 22.2% from the total. Container ships registered, in the same year 35.3%. The LPG type vessels traffic represented 29% and the LNG type vessels 9% while the oil tankers recorded approximately 1.3%. The total ship transit registered through the Panama Canal in 2017 was 11,992. [5]

In 2018 the highest vessel traffic which transited the Panama Canal was registered on the routes between the ports situated on the East Coast of SUA and ports from Asia.

The data presented in table 2, expressed in long tones, presents a comparative analysis for 2017 and 2018 for the most representative wares which were operated through the Panama Canal.

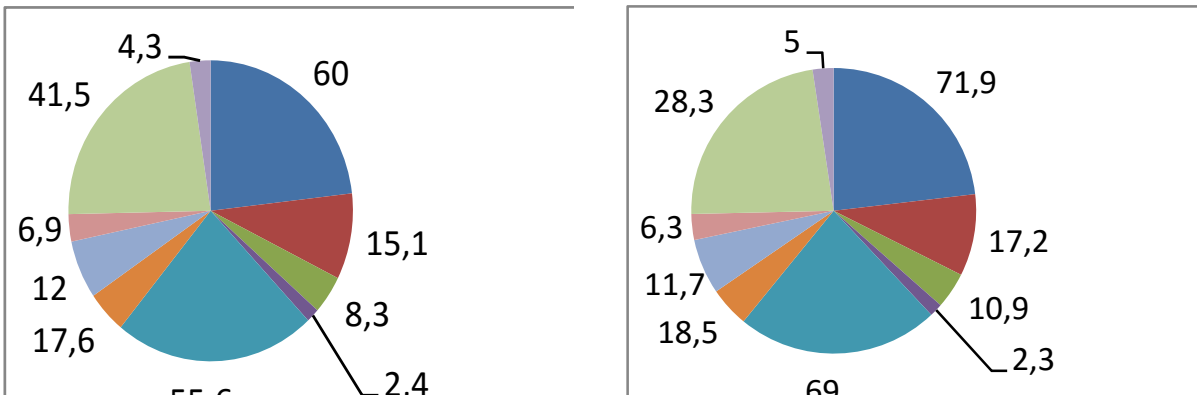

Figure 2

Wares	Petroleum	Grains	Chemicals	Nitrates	Refrigerated	Container	Coal	Ores	Steel	Others
2017	60	41,5	15,1	8,3	2,4	55,6	17,6	12	6,9	4,3
2018	71,9	28,3	17,2	10,9	2,3	69	18,5	11,7	6,3	5

Table 2

From the point of view of Neopanamax type ships it is noted that container ships have registered in this year a traffic increase through the Canal by 49%, LPG type vessels represented 24% and LNG type vessels were 12%. Panamax type container ships have registered in the same year traffic of 14%.

The total transit registered through the Panama Canal in 2018 was 12,199.

4. Conclusions

This paper could be finished with some conclusions which we highlighted in the furthered.

The expansion of the Panama Channel has made it possible to optimize ship traffic and optimize maritime transport. Gas pollution has also been reduced by introducing new software, upgrading vessels from a constructive point of view, and improving channel traffic. A new set of locks with superior performance was implemented compared to the original ones that the channel had.

The comparative analysis for the period 2015-2018 revealed significant developments.

Finally, I can say that this work can be a starting point for developing a future study in the field, both for students and for informing port authorities.

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