



The construction of a new dry dock in the Port of La Luz and Las Palmas and its impact on the maritime sector of the Canary Islands

M.C Adrián de Ganzo^{1,*}, V. González-Guerra², J.A. González-Almeida¹

ARTICLE INFO

Article history:

Received 14 May 2022;
in revised from 26 July 2022;
accepted 31 July 2022.

Keywords:

dry dock, infrastructure, beach a ship, shipyard's, implementation.

© SEECMAR | All rights reserved

ABSTRACT

The present paper tries to show the implementation of a dry dock in La Luz y Las Palmas port and the improvements that it will bring not only in infrastructure but also in other social and economic aspects of the Canary Islands. In the first part of this project, we have made a small revision to the history of the shipyards, the most important shipyards of Canary Islands and Astilleros Canarios S.A. At the second part of this project, we inquire more about the different elements of a dry dock, and the different infrastructures it has, we will also know how to beach a ship thanks to the interview of different professionals dedicated to the sector. Finally, we will see the results section where we will talk about the construction and exploitation of the dry dock.

1. Introduction.

1.1. History of the shipyards.

The tradition of the naval industry on the Atlantic coast left its mark throughout the peninsular geography. Despite the fact that in Roman times there were the first steps in the construction of rudimentary ships, it was not until the Middle Ages when the emergence began in the north of the peninsula thanks to the abundance of wood and iron. Despite the possibilities they offered, it was not until the reign of the Catholic Monarchs that the incipient shipping industries took a qualitative leap.

The seventeenth century is characterized by being a century of economic contraction. During the reign of Felipe III, the traditional construction of large galleons was abandoned for lighter, faster and more maneuverable ones. Shipbuilding by private shipowners was cheaper and avoided the malaise caused by royal requisitions of shipbuilding materials. The drawbacks were notorious as shipping companies tried to save as much as possible, using inferior qualities. In this way, the shipowners weakened the ships seeking a greater cargo capacity in the

holds, since on each trip to the colonies or any European port, the benefits were generally high, as was also the risk that the ship would not return. to its port of origin.

Today's shipyards have their primitive origin in the birth of the Nation States and their need to build, maintain and supply a whole maritime industry dedicated to its national navies. During the 19th century there were substantial changes in the technological field and in the transformations of international shipbuilding. In this way, from 1820 the first iron ships emerged in England, permanently discarding the sail. Until the end of the century there was not a steel industry powerful enough to adapt to the change, and it would take even longer to have its own machinery to achieve the change from the propulsion of the sail to steam in Spain.

1.2. Canary Islands shipyards.

Since the origin of humanity, man and the sea have been closely linked, ships have allowed us to search for food and to be the fundamental axis of the economy since ancient civilizations. In the Canary Islands, a land that has been in contact and always related to the sea, since the foundation of its ports, has been forced to have repair centers for ships that dock or for the construction of new ships.

¹Lecturer in Naval Construction area. Departamento de Ingeniería Civil, Náutica y Marítima. Universidad de La Laguna.

²Merchant Navy Officer at Naviera Armas S.A.

*Corresponding author: M.C Adrián de Ganzo. E-mail Address: madriang@ull.edu.es

1.3. Port of Santa Cruz de Tenerife.

Naval repair in the Port of Santa Cruz de Tenerife was deeply rooted, its first shipyards were very close to the population center, on its beaches. With the expansion of the port, these shipyards changed their location to the bufadero area or the current CAPSA container terminal, finally disappearing due to the expansion of the port. There were dry docks such as those of Hamilton and Elder, the dry dock of the Port Works Board founded in 1919. These shipyards were dedicated to the construction of ships such as sloops, barges, schooners. Finally, the Nuvasa shipyard was founded with a Syncrolift system for the stranding of ships, there was a floating dock, they finally disappeared after the extensions.

Figure 1: Steps of the Nuvasa shipyard.



Source: eldiario.es.

For many years the repair sector in the port lacked activity until 2014, when the Tenerife Shipyard company began its activity. This company returns naval repairs to the port and has new projects that may make Puerto Santa Crucero grow in the future.

Tenerife Shipyards. This company is part of Grupo Hidramar S.L. and is located in the dock of Dique del Este, Santa Cruz de Tenerife. They provide services and technical assistance in the naval sector. The services offered by Tenerife Shipyards are: Hydraulics, Engines, Steel, Mechanics, Piping (Commissioning and Testing), Auxiliary Services and Scaffolding (Spare Parts), etc.

Astilleros Alamar Canarias S.L This small shipyard is located in the industrial area of Granadilla de Abona, Tenerife. It is dedicated to the construction and repair of small boats such as yachts and fishing boats.

1.4. Port of La Luz and Las Palmas.

The first reference to a naval repair on the island of Gran Canaria was in the landfall that Christopher Columbus made on the island. The ship “La Pinta” had suffered damage to the rudder and was repaired on the island. Although there was some type of shipbuilding and repair activity, nothing has been confirmed until the foundation of the first shipyard in Puerto del Real de Las Palmas, the San Telmo shipyard. The works began on May 30, 1811 and ended in November 1812; it was dedicated to the

construction of schooner ships. By 1882 the shipyard had built 297 ships.

Figure 2: Astilleros de San Telmo. Las Palmas de Gran Canaria. 1860-1866.



Source: apuntesjdrz.blogspot.com.

Due to the inclement weather in the Port of San Telmo, it is decided that the best location is in the bay of the islets, offering a natural refuge. Once the Santa Catalina and León y Castillo docks were built, new shipyards were re-founded in the area known as Sanapú dock. At present, and after numerous extensions to the Port of La Luz and Las Palmas, there are numerous shipyards and companies related to the naval repair sector, such as Hidramar, Zamakona or Astican.

Hidramar S.L. Hidramar is a naval services company that has been offering its assistance since 1989. One of the star services of this company are welding operations. Hidramar offers its services on land and on board vessels, 24 hours a day and 7 days a week.

Zamakona ShipYard. Mostly known as Reptnaval, it is a shipyard dedicated to the repair and maintenance of ships with a maximum dry weight of 5500 TM. They have more than 40 years of experience in the naval sector. It was founded in 1972 by Pedro Garaygordóbil, and it was called Napesca. Later, it was renamed as it is today due to the alliance between several companies in the naval sector, including Coast Center Base with Zamakona Yards.

Astilleros de Canarias S.A. (Astican). Is a privately owned naval repair company, installed in the Port of La Luz and Las Palmas. It was founded in 1973, although it was not fully operational until 1976.

Astican is currently one of the most important shipyards in the mid-Atlantic area, having a strategic location between America, Europe and Africa, which allows the Port of La Luz and Las Palmas to complete a series of services that make it more competitive than the nearest ports and be leaders.

Astican since 2000 entered one of the most important markets, such as the repair of oil rigs. Currently, companies choose the Canarian ports to carry out repairs and supplies for these vessels, which generate significant income. Astican currently

has a collaboration agreement with Roll Royce, recently purchased by the giant Kongsberg on April 1, 2019, which allows the assembly and maintenance of the propellants of the oil rigs.

Its facilities have a lifting platform (Syncrolift) with a lifting capacity of 10,000 tons, 175 meters long and 30 meters wide. It has 7 stranding lines, 3 of them 120 meters long, 2 180 meters long and finally another 2 220 meters long. It has a dock of 700 meters and an approximate draft of between 8 and 12 meters. In the Reina Sofía dock, they have a 270-meter mooring line with a draft of up to 21 meters, which allows repairing vessels with large drafts. A storage area and there is also Astican Tenerife, which allows you to move or hire local companies for the maintenance and repair of ships.

2. Methodology.

A dry dock is an artificial dock designed for the repair or construction of ships, which is connected by one of its parts to navigable waters and separated by an entrance lock to the dike. They are constructions that are made on land and in U-shape. The walls of the dike must be made of strong and solid materials, as well as the bottom of the dock that must withstand the great pressures generated when the ship is grounded, as well as must withstand the pressure of the water when it is full. For to support these large masses it is recommended that the dike be built in a stratum rocky. If this was not possible, some pillars would be placed so that the base was the strongest possible.

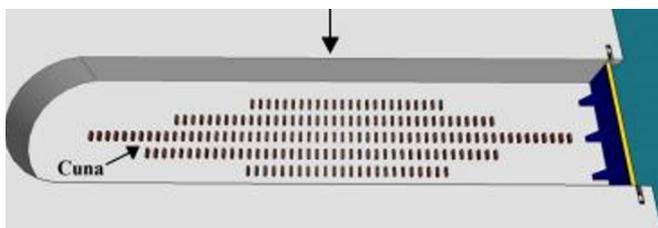
A dry dock is made up of several pieces of equipment, among which we highlight the pumps, bilge valves, flood valves, dump valves, air compressors and Repair shops.

Floating docks perform the same function as a dry dock, they remove the part submerged hull of a ship to perform different operations from cleaning and hull painting to ship repair and welding operations. Once the boat is inside, it is necessary to extract the water that is in the ballast tanks of the dock, this will allow the dock to rise, and allow the ship to position itself between the side walls and on the docking bed.

In this part of the work, we will talk in a general way about the different elements that they have the dry docks to be able to deepen in the study of them.

Bucket: Work area where the vessel will be placed in position and will rest in a cradle of grounding. Before making the bucket, a great study of the topography of the land should be done and of the different types of rock that have been, since it will be the part of the dry dock that supports the weight of the ship. The bucket is usually made of concrete and steel.

Figure 4: Dry Dock. Bucket.



Source: anuarioempresas.proexca.es.

Exhaustion Facility: This part of the dry dock is where the so-called pump room are located filling or draining. They usually have helical and centrifugal pumps, which allow you to better performance. Helical pumps or also known as screw pumps are used in these facilities because they allow pumping viscous fluids, which can contain some kind of solid. Centrifugal pumps are the most used for any type of fluid. In general, there are two independent pump rooms, a main and auxiliary pump.

Lock: The lock is a structure that allows the containment of the water and to be able to drain inside the bucket the water it contains, so that the ship is placed on the bed and can beach it.

Maritime and Mechanical Rig: The dry docks are provided with systems that allow the mooring of ships and position ourselves at the exact point to strand them in the crib.

2.1. Preparing a ship for entry into a dry dock

The first thing that is done to enter the dock is a stability calculation, where we will take into account the weights, drafts, seats. Once done, we will send it to the shipyard together with the grounding plans, this grounding plan is very important, since the shipyard will be able to make the cradle of the ship with him. Once approved by the shipyard to enter, we will be in contact with them for the entrance to the dike and we will have to wait at the right time for entry (Tides). Once prepared for the entrance to the dike we can enter with our own means, with the help of the tugboats or with our lines that will be connected to machines that will move the ship. A Once the ship is inside the dock, we will stay in position with the help of the capes. the gate will close and the dyke will begin to be emptied.

Figure 5: Beached in Gibdock Volcán del Teide.



Source: Authors.

Figure 3: Canarian Shipyards. Stranding lines.



Source: anuarioempresas.proexca.es.

This moment is one of the most critical moments of the dike entrance, since there could be some type of displacement of the ship and create structural damage that could until the ship is rendered useless, for this the ship's drainage procedure will be done little by little. First it will arrive until the moment in which the ship touches the bed, there the divers or Underwater drones will determine if the ship is in position. Once you have the OK, water will continue to drain until it meets the cooling inlet auxiliary engines of the ship, there will be the order to uncouple the same and the ship's emergency engine will operate. Finally, when the bilge work, a shore outlet, sewage outlet, outlet for the shrimp, for fresh water and for the machine.

Field work has been carried out to obtain first-hand results on the study of the implementation of the dry dock by the company Astilleros Canarios S.A. in the Port of La Luz and Las Palmas. This part of the investigation has been carried out thanks to the collaboration of different bodies of the Port Authority, and the workers of Astican, which has allowed us to know in situ how its characteristics will be, operation, type of traffic to which it will be destined.

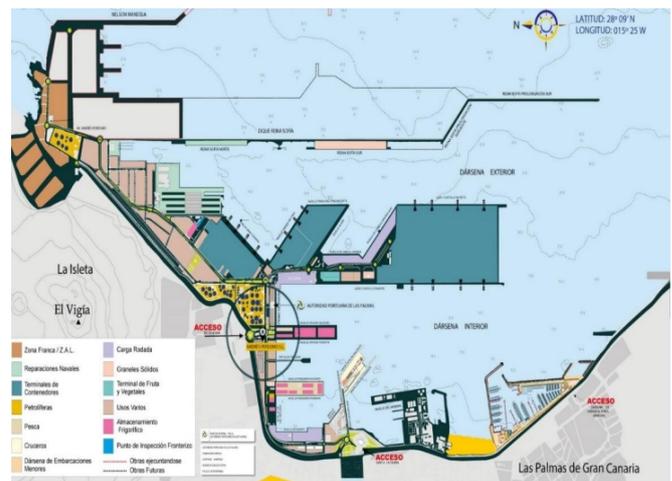
3. Results.

Dam characteristics: The dry dock to be built in the Port of La Luz and Las Palmas will be a dike that will have dimensions of 326 meters in length and 46 meters in width and it will allow the grounding of ships of up to 96,000 dwt (Dead Weight Tonnage). Will be the first dry dock built from prefabricated caissons and the first in the Canary Islands. On This part of the work, we will focus on the construction and operation of the dry dock.

Location: The Port of La Luz and Las Palmas has undergone changes throughout its history in its infrastructures, adapting to both social and economic needs, not only of the island, if not the entire autonomous, national and world territory. This has allowed create several docks within the port such as the historic Santa Catalina dock, Grande, León and Castillo dock,

even the most current ones such as the Reina Sofía dam or the Nelson Mandela Dam (former Sphinx Pier).

Figure 6: "General plan" - Puerto de La Luz and Las Palmas.



Source: grupoperdomo.com.

The dam will be located between the inner Astican docks and the Reina Sofía dam, this will make the sheet of water that currently exists be occupied not only for the dike dry, if not for the expansion of its facilities, services and internal docks of the shipyard, allowing the docking of ships that want to carry out some kind of repair, and it can be carried out afloat, such as cleaning of hull docking of Platforms for your repair or offshore vessels.

Figure 7: 3D recreation of the shipyard with the dock.



Source: Authors.

Construction: The shipyard today is in the study phase of the project; they have invited to various construction companies to see offers and improvements to optimize time and resources to the project. Once all the companies have presented their offers, Astican will decide with which company it decides to approach the project. In this part of the job, we will explain some of the phases of the project, for its execution.

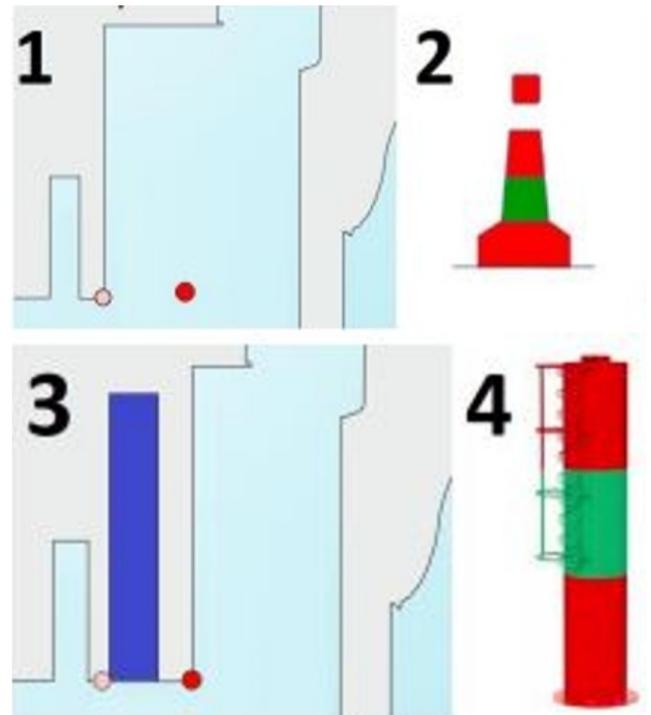
Beaconing: Today in most ports around the world there are extensions in their installations. The closure of a port for works is not envisaged, as this will have repercussions on economic losses not only to the port but to the locality or an entire region, and ships they would look for ports where their operation would not be affected. Currently in the Puerto de la Luz and de las Palmas are carrying out different works such as the expansion of the Reina Sofía dock or the expansion of the Santa Catalina cruise ship dock, in all these cases we see how the port activity is combined with the works. For As a result, the port changes its beacons so that the area where the work is being carried out does not obstruct the maritime traffic. Here are some changes that the user will need to make port to undertake the works of the dry dock and expansion of the Astican docks.

Buoys and lighthouses and different brands: There are now a red-banded pole lighthouse on the south Astican pier green. Before starting the work, the first thing to do is to place a buoy where the new tip of the dike will be located approximately. This location will be readjusted during construction. Once the work is finished, the post will be placed again at the tip of the new dike.

Also, to the drawers, after their construction when they are located, they will have lights on their entire surface that will make it possible to be observed by the ships that are performing maneuvers through the different nearby docks.

Seabed dredging and preparation: Dredging is the cleaning and bottom augmentation operation on a specific site. The increased draft of the new ships and the sludge deposit make many ports They use this means to expand or clean the access channels and berths. At the Astican dock, different soil studies have been carried out to see if it is the construction of the dry dock in that location is feasible, such as a bathymetry. The Bathymetric maps are representations of the underwater relief

Figure 8: Recreation of the position of the buoys during the works.



Source: Authors.

of a study area in concrete. These maps have lines called isobaths. These isobaths represent a different depth. When these are very close to each other, it is said that the background level is accused, however, if they are separated from each other, it is said that the background it has a more gradual level.

From the studies carried out on the ground of the docks near Astican where wants to locate the dike it was determined that the soil is suitable to support the weight of the dike and that you have to dredge it.

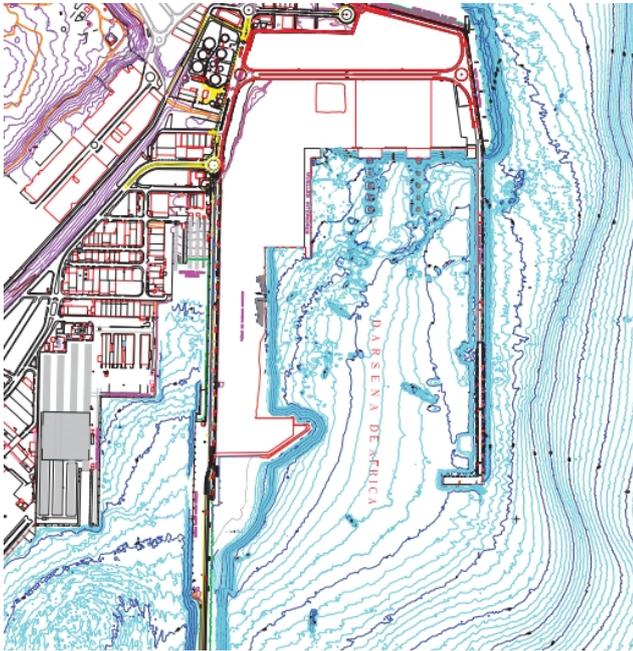
Today the shipyard has drafts in its docks that go from 8 meters to 14 being a bottom with a gradual level. With the dredging of the dock, it would be possible to increase the draft of the docks and allow the docking of large platforms and vessels with very large drafts.

Once the dredging operations have been carried out, the sidewalk of foundation. The sidewalks is the base where the prefabricated drawers will sit. These must be prepared to withstand the weight of the construction, and function as a base uniform.

For the construction of the sidewalks, you will need pontoons where to deposit the material, take it to its place and with a crane move it to the seabed or ships specialized such as gan-guiles, which are vessels prepared for the deposit of material in the background. This type of vessel consists of warehouses where all the Finally, when it reaches the desired position, it opens its bottom and drops the material.

Drawer construction: The realization of a concrete box is carried out as follows: First In a pontoon or on the dock, what will be the skeleton of the cajonero is made, for this uses tons

Figure 9: Bathymetry Example.



Source: palmasport.es.

of interlocking steel to create that structure. Once done, it takes to the drawer, where the entire structure is formed and concrete is poured, creating these giants. Once the formwork and concreting process is finished, the launching process. This process is perhaps one of the most delicate of the operation since it can damage both the newly built drawer and the drawer. To finish the drawer is docked at the docks next to the work for the completion of the last details, at the waiting for the last positioning and final funding process.

Figure 10: Example of the type of caisson to be used in the dry dock.



Source: Authors.

Positioning of the drawers and final anchoring: Once the large concrete caissons have been built, they will be moved to their exact location, for this a rigorous deployment of both technical means and humans and great expertise of the captains of the tugboats that will move these boxes to its exact position and

final anchoring.

Figure 11: Tugboat towing a box for its final positioning.



Source: canaryports.es.

The tugboats will be in charge of moving these large boxes to their final location, for this they will be tied to the tugs and transferred to the position that the engineer or the project manager communicates to the captain.

Filling the drawers and finishing the work: For drawer cell filling operations, it is important to look at the characteristics of the material to be deposited inside them, since they must be compatible with steel and concrete. This process would be carried out once the drawers are already at anchor. The type of material that is used for the filling can proceed quarries, dredging or excavations.

Conclusions.

The completion of the new dry dock represents an expansion of Astican's business in different areas, which will increase its repair and production activity favourably. It becomes a geographically well located and highly competitive, which will also help the port of also help the Port of La Luz and Las Palmas to economically expand, positioning the island in a higher level of ship repairs.

The construction of this dry dock will allow increased traffic maritime in the Canary Islands, since the entry into service of this, will enable that shipping companies have a new option for large ships. This It would also allow other sectors such as cruise ships, transshipment containers or bunkering increase.

The dock will also allow for a shipyard upgrade to accommodate to the new times, with the purchase and update of new equipment necessary for the stranding of ships. Job creation not only directly the one that will be created by the shipyard itself, if not for the industry. Small and medium-sized local businesses that perform work in the sector, they will be able to enlarge their templates and they will increase their jobs.

References.

ANP. (s. f.). The National Ports Agency. Agence Nationale des Ports. <https://www.anp.org.ma/en/port/dakhla/page/Presentation>

Astilleros Canarios: reparación, mantenimiento, conversión. Unidades offshore. - ASTICAN Astilleros Canarios. (s. f.). Astican - Astilleros de Canarias. <https://www.astican.es/es/>

Borzani, G. (1971). El dique seco de Monfalcone - Italia (Informes de la Construcción Vol. 23, nº 228). Consejo Superior de Investigaciones Científicas.

Cárdenes Acosta, F. (2012). Historia de San Telmo y su entorno. <https://mdc.ulpgc.es/utills/getfile/collection/MDC/id/184-280/filename/265650.pdf>, Las Palmas de Gran Canaria.

Clavero, M. y Ortega-Sánchez, M. (2017). Proyecto y Construcción de Obras Marítimas. ETSI Caminos, Canales y Puertos. Universidad de Granada.

Clúster Marítimo Español. (s. f.). Una mirada a la historia de los astilleros - Clúster Marítimo Español - La mar nos une. <https://www.clustermaritimo.es/2013/07/30/una-mirada-a-la-historia-de-los-astilleros/>

Fccco. (5 de noviembre de 2008). Dique flotante Mar del Aneto [Video]. YouTube. <https://www.youtube.com/watch?v=PPgAaNAcFPo>

Fernández, S. (28 de octubre de 2022). Astican triplica su tamaño para reparar barcos de alto tonelaje. Canarias7. <https://www.canarias7.es/economia/astican-triplica-su-tamano-para-reparar-barcos-de-alto-tonelaje-GM4068594>

Grau Albert, J. I. (2005). Experiencias en obras portuarias. Recomendaciones para el diseño y la ejecución. Puertos, (128), 24-26.

Jiménez, J. L. (3 de marzo de 2019). 30 años de la privati-

zación de los astilleros de Canarias. abc. https://www.abc.es/espana/canarias/abci-30-anos-privatizacion-astilleros-canarias-201903030346_noticia.html

Voz, L. (29 de junio de 2019). Canarias, nuevo rival de los astilleros de Cádiz en la reparación de cruceros. lavoz. https://www.lavozdigital.es/cadiz/lvdi-canarias-nuevo-rival-astilleros-cadiz-acogida-cruceros-201906291159_noticia.html

Pita Olalla, Eloy; Grau Albert, Juan Ignacio y Pérez Caldentey, Alejandro (2008). Manual para el diseño y la ejecución de cajones flotantes de hormigón armado para obras portuarias. En: "IV Congreso de Asociación científico-técnica del hormigón estructural (ACHE)", 24/11/2008-27/11/2008, Valencia, España. ISBN 978-84-89670-62-4.

Sobre Nosotros - Zamakona Yards. (s. f.). Zamakona Yards: construcción, conversión, reparación, mantenimiento y construcción naval. <http://www.zamakonayards.com/grupo/sobre-nosotros/>

Structuralia Blog. (21 de septiembre de 2016). Obras marítimas: los diques verticales. Blog y noticias sobre ingeniería — Structuralia. <https://blog.structuralia.com/obras-maritimas-los-diques-verticales>

ULLaudiovisual - Universidad de La Laguna. (28 de julio de 2014). Charla: "Astilleros de reparación en el ámbito del puerto de Santa Cruz de Tenerife" [Video]. YouTube. <https://www.youtube.com/watch?v=jLlBPiPxKvk>