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ARTICLE

New Investigations for Offshore and Onshore Structures

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ABSTRACT

In this research the investigated parameters are given as below: The History of offshore and onshore construction is given where onshore structures as storage tanks and breakwaters with Estacada are mentioned with hierarchical steps. To the offshore structures belong stationary fixed platforms (steel, concrete, combined, arctic) with floating (Jack-up, semi-submersibles, TLP,…) and pipe line construction. This issues are given as State-of-the-art and written as new examined innovative researches.

1. Introduction

In 1901 for sea drilling exploitation was deciding to drain Bibi Heybat bay. Working to create a landfill in Bibi Heybat bay began in 1911 at project and under the leadership Polonius engineers P.N.Pototsky. This structure was second big hydraulics project in the XX century after famous Panama canal. The common work by construction of this structure was finished only in 1932 (Fig.1). After Revolution in Russia and finished Azerbaijan Democratic Republic, the offshore and onshore oil and gas fields as all natural resources were de-"nationalization" again by Soviet Bolshevik Government.

In the year of 1934 they were constructed and established first in the world metallic base offshore platforms. For Geological Research and Ship Drilling it was established an offshore platform for shallow water offshore drilling. For comparison, 13 years earlier than those drilled as a fixed steel platform in USA , at Mexican gulf which was 6 m deep. After World War II, in 1949 it was discovered uncial offshore oilfield, "new either wonders" at Neft Dashlari (Oily Rocks), town on the piles, Estacada-town (Fig. 2).

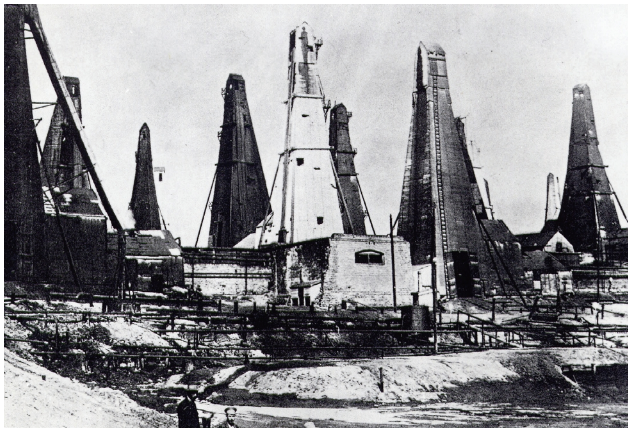

Figure 1. The first structure on the sea Bibi-Heybat bay [1

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Figure 2. Estacada town "Neft Dashlari" (Oil Rocks)[2]

The active development of design and construction of the deep water offshore drilling of the oil and gas fields in the North Sea and Arctic sea can be given after 1970 years which let to build new original type steel, pre-stressed reinforcement concrete, ace-proof, combined offshore platforms, different lay barge ships for pipe-line constructions and underwater pipe-line systems. More over the new floating service structures are constructed as : jack-up, semi-submersibles, tension-leg platforms, articulated columns and etc.. In this leading American, French, English, Canadian, Norwegian, Swedish, Danish firms, as Doris, ETPM, Unocal, Norske Veritas, Statoil and others elaborated new methods for the construction lifting, transportation equipments on the sea and new calculation computer methods are given for the design of these structures on the effects of wave, wind, flow, earthquake, ice forces and different loading from technological equipments. Unfortunately, in Azerbaijan the first deep-water offshore stationary platform was installed at the first time (84 meters) at 1977. Azerbaijan was the first republic in Soviet Union which declared its independence from the Soviet Union. After "Perestryka", at break-down of the Soviet Union and establishment Azerbaijan Republic, in 1994 "Contract of the Century" was signed for the joint development of the three major fields-Azeri, Chirag and Gunashli districts. It was originally signed bids with well-known foreign oil companies of the USA (Amoco, Unocal and Pennzoil); United Kingdom (British Petroleum and Ramco); Norway (Statoil); Russia (LU-Koil), Turkey (Turkish Petroleum-TPAO) and Saudi Arabia (Delta Nimir). Since then Exxon (USA) and ltochu (Japan) have joined to the consortium leading by AIOC (Azerbaijan International Operating Company). The $7.4 billion investment contract provides for oil extraction, transportation, construction of pipelines, and development of other crucial aspects of the infrastructure.

In 26th May 2005 it was finished the construction of the Baku-Tbilisi-Ceyhan pipe line (Fig.3). The oil pipe-line construction project which has 1.760 kilometer length was designed to transmit oil from Khazar (Caspian) sea to the Sangachal terminal through Georgia to the Turkish port of Ceyhan at the Mediterranean coast. This pipe-line will change the geopolitics of the region and will open New Era in the Region.

Figure 3. Baku-Tbilisi-Ceyhan pipeline will run through territory of 3 countries

The coastal structures have more ancient history then offshore structures. The man always needs the protection of coasts and organization jetties for ship terminals. The detailed classification of coastal engineering problems are given in Fig.4.

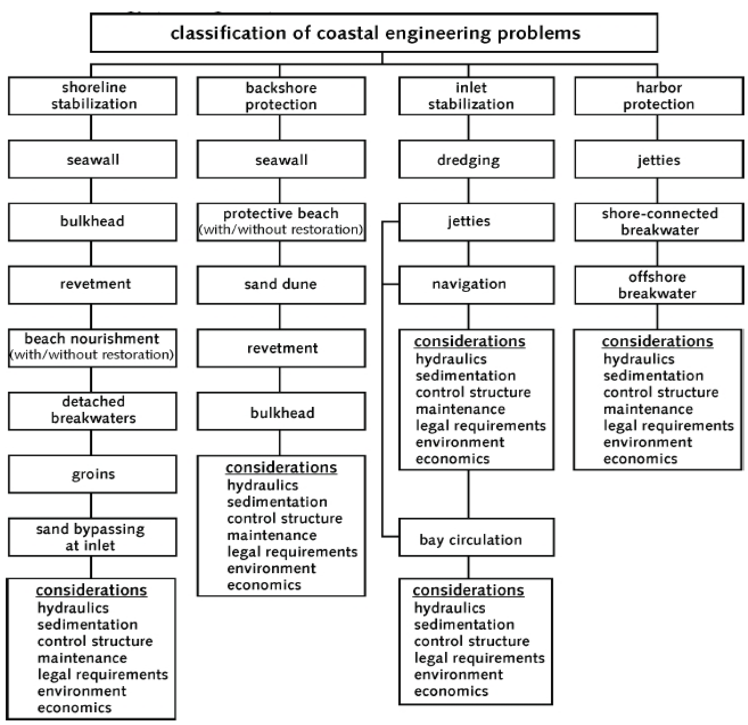

Figure 4. Classification of coastal structures (SOM,1984) [3-14]

2. Onshore Structures

2.1 Storage Tan

The storage tanks may be designed as cylindrical, spherical and elevated tank structures: (Fig.5 a,b,c)

(a)

(b) (c)

Figure 5. Storage tanks designation

The storage tanks are used for water and liquid petroleum and gas depot. Cylindrical steel tanks are critical infrastructural elements which are used to store liquid fuels, industrial chemicals and potable water (Figure 6.)

Figure 6.1. The Destroying effect of chemicals in tanks

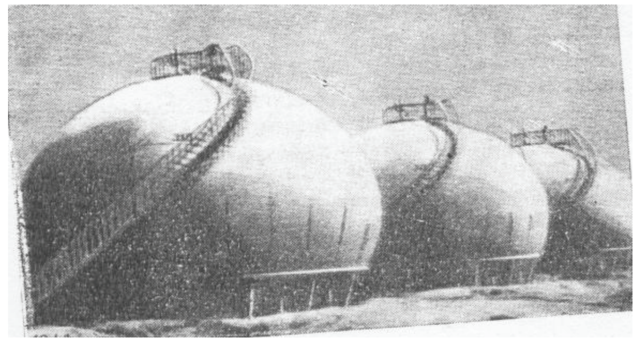

Figure 6.2. Another class of above ground tanks is called elevated tanks

2.2. Breakwaters

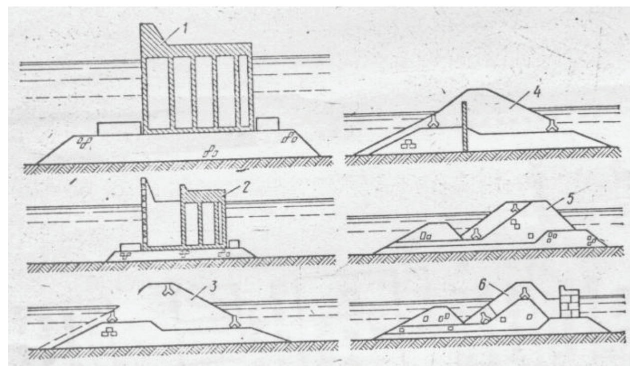

Figure 6.2. (a) Breakwater structures

1-Keson masife constructionı; 2- Perforge front wall with ile Keson masife construction; 3 –Tetrapod constructed breakwaterı; 4 – Inside constructed Tetrapod breakwater ı; 5 –Stone filled Breakwater; 6 – Stone wall layer at the breakwater construction

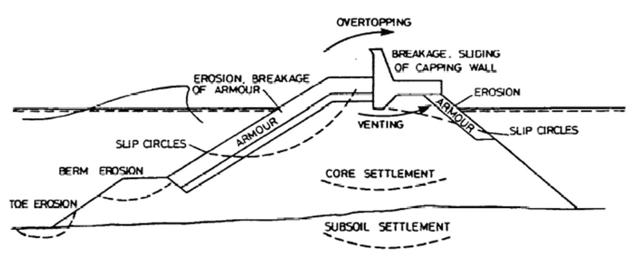

Figure 6.2. (b) Potential failure modes for breakwaters[19]

Figure 6.2. (c) Tetrapod type breakwater

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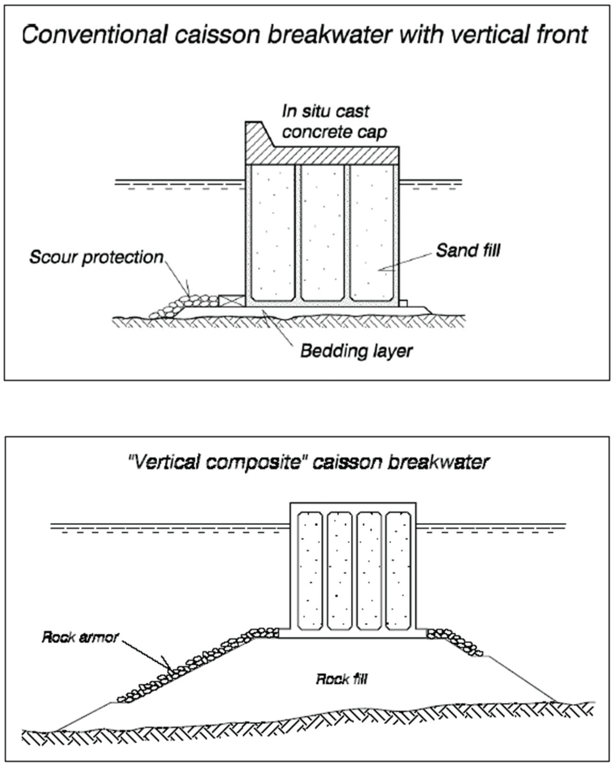

Figure 6.2. (d) Other Onshore Structures[17,18,19]

Figure 6.2. (e) Different Construction of Breakwaters [17, 18, 19]

3. Offshore Structures

3.1 Stationary Fixed Platforms (steel, concrete, combined, arctic)

The Institute for Offshore Geological Research and Ship Drilling in Baku (Azerbaijan)at 1934, was established where the first metallic base platform construction plan was realized for off-shore drilling, 13 years earlier than those drilled by in the USA (Gulf of Mexico) for shallow water structures. Today there are constructed over 10000 deep water and shallow water offshore structures at difference continental shelf's.

Since 1969 the classification of offshore structures are given in Figure 12.

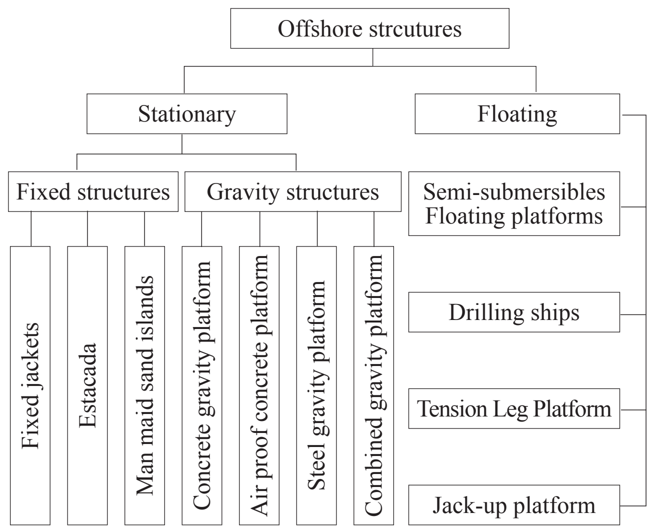

Figure 7.1. Offshore Structure Identification[15]

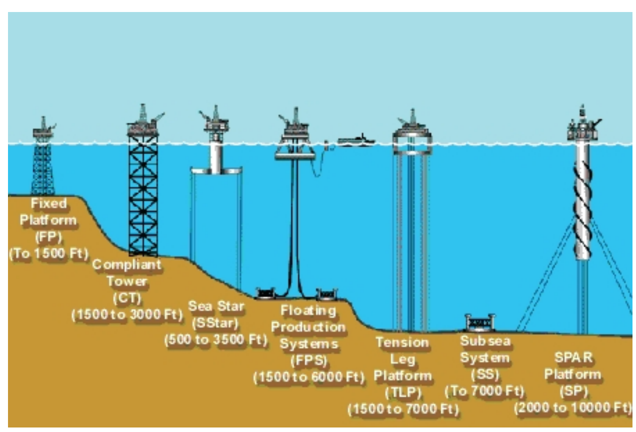

Figure 7.2. Different types of Offshore Structure draft sketches[15]

An offshore structure must withstand to the several loads. Water and wind are constant factors, but conditions can vary drastically. Waves and currents show destroying effects on a platform, even on calm days, and it must be able to withstand to this different force loads, which can be observed as sudden violent storms and 100-foot (30m) waves. It must also withstand to the forces of winds and the destroying forces of hurricane storms, as well as of prevailing ocean breezes.

It also must have enough strength to bear the weight of its different equipment on the platform. Drilling platforms support a different amount of weight than the oil production platforms, and platforms for both drilling and oil production must support even more weight.

Most fixed platforms being built today are for both for drilling and for oil production. These combinations of platforms are more expanded and can be more expensive than the smaller, single-purpose structures. The deep-water offshore platforms of continental shelf are tremendous engineering structures. The height of these platforms are more than 300 m. The weight of structures is about 400000 kN [18].

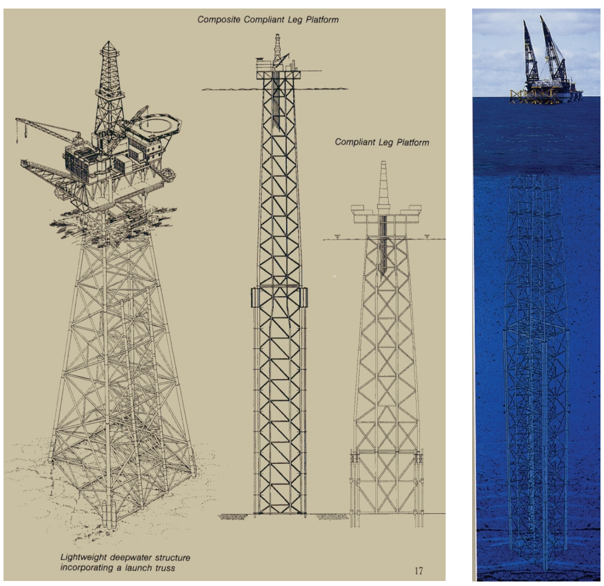

Figure 7.3. Innovation in Offshore Structures [15]

While traditional fixed platforms are far away and meanwhile the most numerous and modern technologies have created for a new generation of fixed platforms and floating platforms.

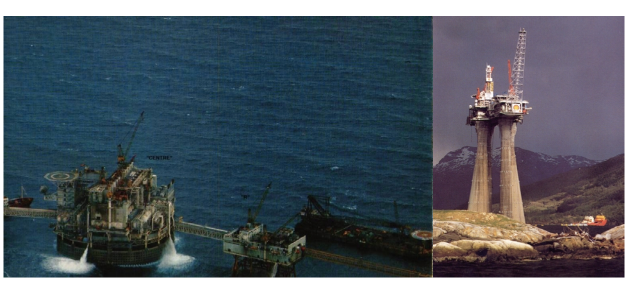

Figure 7.4. Different type of innovation at diffent layers [15]

Only during 1970-82 it was recorded that the 560 damaged case were recorded for offshore structures. In 93 damaged cases the reason was the failure of structures because of different ballast of mobile loads from natural effects.

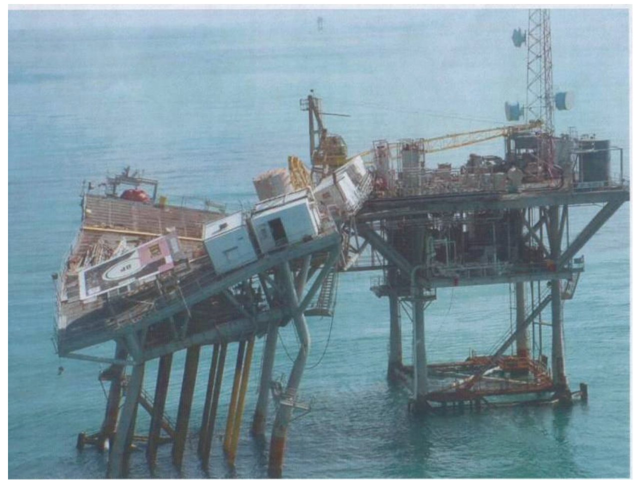

Figure 7.5. Failure at Offshore platforms [15]

3.2 Floating (Jack-up, semi-submersibles, TLP,etc…)

In relatively shallow water the driller may use a jack-up drilling rig. The deck of the rig has a barge –like steel structure that supports the equipment on it. Adjustable legs that can be lowered to the ocean floor are attached onto the deck. At the drilling site, the legs are lowered and secured at the seabed, and the drilling deck and equipment are raised above the waves. Because practical lengths of their legs are limited, jack-up rigs are not suitable for certain depths.

Figure 8.1. New type of offshore platforms [15]

In deeper water, the drilling contractor turns into the drill ships or semi-submersible drilling barges. Floating

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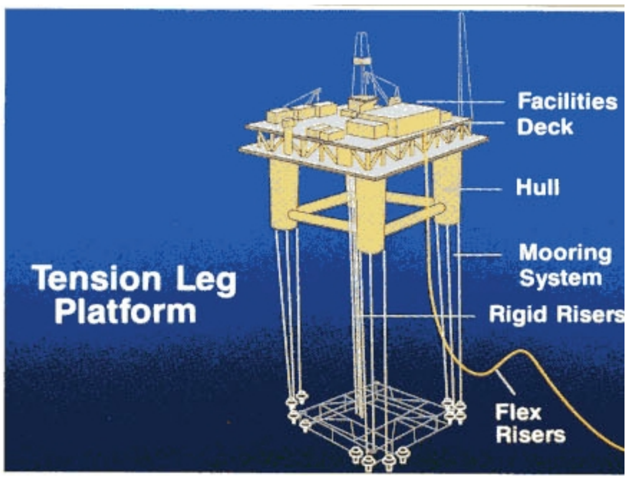
platforms are of two basic types, the tension leg platform and the floating production platform.

The tension leg platform consists of deck that sits on the top of four columns. The tendons run from each column to the sea floor, where they are anchored by piles. The tendons hold the columns partially submerged and are flexible enough to move with the ocean wave effects. A long flexible riser carries petroleum to the deck of the platform.



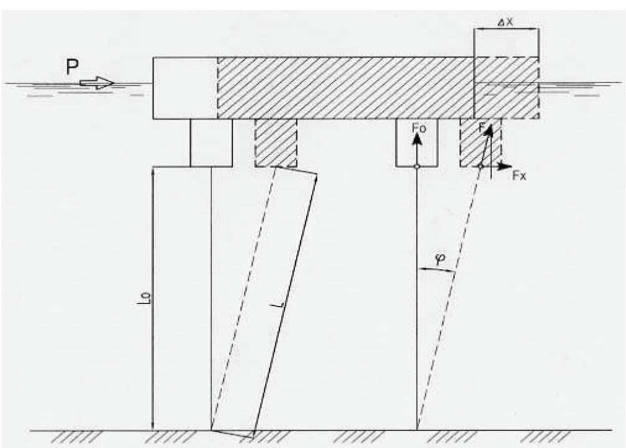


Figure 8.2. Moving Offshore Platforms [15]

A second type of floating platform is called the floating production unit. A ship or a semi-submersible barge is outfitted with drilling and production equipment and anchored over the well site. It is als off connected to the well by a riser. Floating production units can be reuse, because they are mobile.

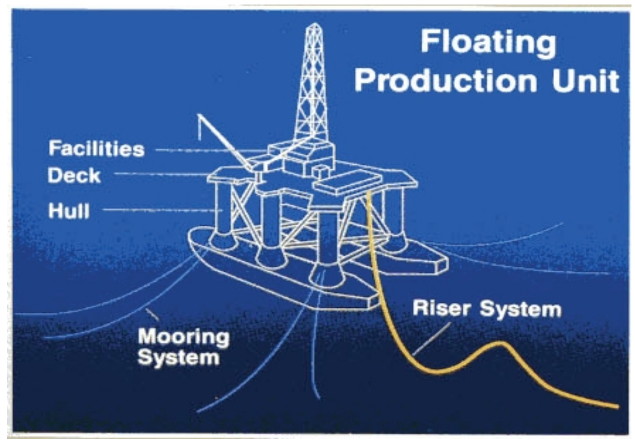


Figure 8.3. Last innovation at the Construction of offshore platforms [15]

3.3 Pipe Line

Offshore pipelines are used for transportation of fluid from offshore fields to the shore. A typical cross-section for a large diameter pipeline is shown in the below Figure 9.1. The pipe itself is mostly manufactured of steel, less often of other materials which are e.g. reinforced plastic.

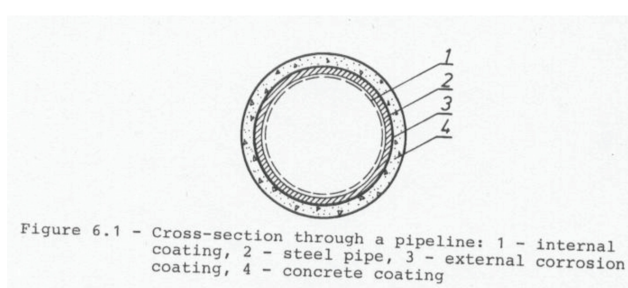


Figure 9.1. Cross Section of Gasoline Pipe Line [15]

Pipelines are built up by welding of individual pipes into a continuous line. Quality of all welded joints is thoroughly inspected by X-ray methods, sometimes also by ultrasonic or other methods. Thereafter the joints are covered by a dope (a bitumen composite coating) so that the surface of the joints is flush to the outer surface of the concrete coating. Thereafter the pipeline is submerged in water and lowered onto the seabed by selected laying methods.

A number of laying methods are used and proposed for installation e.g. stinger method, J-method and bottom or mid-depth tow methods [19].

For long sections of large diameter pipelines, the stinger method is most used one. In this method, the pipelines string assembled on the lay barge of individual pipe joints which are lowered into the water bottom over a stinger. The stinger supports the pipe at the over bend-transition from horizontal position on the barge to the inclined position in water (Fig. 3.2.2.).

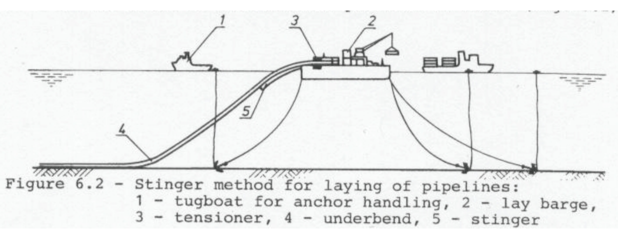


Figure 9.2. Connection of undersea pipeline with onshore [15]

Near the seabed, the pipeline is bent from an inclined position to the actual position on the sea bottom. The pipeline creates a S-shaped curve in this laying method. A tensioned on the lay barge provides to the pipeline with the required tension in order to avoid unacceptable bending stresses in the lower part of suspended pipe – under bend.

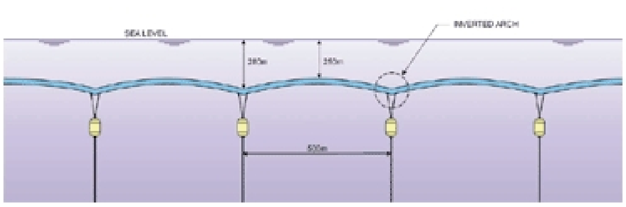


Figure 9.3. Connection of undersea drinking water between Turkey and Cyprus [16]

4. Objectives of the Research

In this research the review of different onshore and offshore structures are given in detailed description with historical development. The need for new innovative techniques is emphasized for better protection of the ecosystem and need new standards for protection the environment in scope of climatic change by using also geographical research. Other disciplines like Engineers from Remote Sensing Division, et. must show a fruitful cooperation for solving this environmental problem.

5. Discussion

We need more innovation to build the new efficient onshore and offshore structures for the requirements of the new industrial facilities with more computer applications using remote control. We need also new devices for construction of the onshore and offshore facilities in short time and in a more optimum design to protect the ecological life in the environment.

6. Conclusion

Today's infrastructure for the construction of efficient onshore and offshore structures are not enough for discovering new ideas against climatic change and protection of ecosystem while the development in innovation at the construction of onshore and offshore constructions are not in good situation[17].

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