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Reshaping of Coastlines as the Beginning of Urban Structures Changes in North Poland

Izabela M. Burda[1], Lucyna Nyka[1], Adam Borodziuk[1]

[1] Gdansk University of Technology, Faculty of Architecture, Narutowicza 11/12, 80-233 Gdansk, Poland

izaburda@pg.gda.pl

Abstract. This article discusses the problem of strategies concerning the processes of re-shaping the Baltic Sea southern coastline applied recently in North Poland. The undertaken research is an attempt to identify the relationship between the modifications of coastline forms and the positive changes of urban structures. First of all, it can be seen that these modifications are needed because of the problems of existing shoreline erosion. It can be also observed, that many realized interventions were helpful to save the land but they did not improve the condition of cities situated along the coast. In these cases, it is impossible to connect the sea coastline with the existing grid of public spaces which is a barrier to creating a system that could be perceived as a coherent landscape.

The basis for proving the importance of special ways of shoreline modifications are comparative studies and in-field analyses. In facing the problems of coastal cities there is a need to analyse the condition of existing urban structures. Many studies made so far show that there are many problems which have to be identified and solved. Worth noting is the fact that these structures have a unique character because of their location. They play an important role as holiday resorts being an attraction for many inhabitants and visitors from all over the world. Such a role plays, for example, an important part in places such as Jarosławiec, Ustka or Kołobrzeg.

However, analysing the strategies applied in recent years, it can be noted that they cannot be the only basis for the strengthening of connections between land and water helping to preserve the land, but they may also play an important role as a factor for initiating urban structures transformations. What is also important, it can be claimed that relationships between sea water and urban structures should be strengthened due to special forms of the coast line. They should be integrated into existing structures making them more comfortable and attractive while also protecting against threats from the water. Playing the role as a protector of land they should use special constructions being at the same time accessible to all users throughout the year and regardless of weather conditions. It is worth emphasizing that special treatment of the coastline helps to establish it as a public domain which is important in achieving high quality urban-water landscapes. Therefore it should be the objective of strategies which are being prepared for parts of coastlines waiting for intervention.

1. Introduction

Problems with reshaping of coastlines in the North Poland region need to be discussed from several points of view. In reference to the problems observed in both the world and the analysed region, and watching recent climate changes, it can be seen that the world's coastal areas are under threat by a rising sea level to a much greater extent than it has been so far. Parts of the shoreline is sinking so fast

that some of it will be below sea level by the year 2050 [1]. Furthermore, both natural and anthropogenic ecosystems and structures in the coastal zones are also being affected by sea level rise, but they have different capacities to adapt. It is worth noting that human constructed hydro-technical structures as well as natural structures can be found along the Polish coastline. However, a significant part of the South Baltic coastline still needs solutions that can tolerate strong winds, storms and periodic flooding from tidal waves. Therefore, many scientists representing different fields therein are asking questions such as how to keep pace with rising sea level and climate changes and how to solve the problems caused by sudden hydro-meteorological phenomena? They wonder if it's possible to find the solutions which will meet the necessary environmental, technical and human requirements. Furthermore, another important issue is to investigate the extent to which coastline transformations affect changes in settlement structures located in the coastal zone. Observing the changes taking place in recent years it is possible to postulate that new forms of protective coastal structures may be an important element and even the basis for the development of coastal towns.

2. Analysis of coastlines transformations

Regarding the problems of coastline transformations there are many issues to study. It is necessary to analyse environmental and technical issues as well as social, legal and economic aspects. Very important for the research is an attempt to understand coastal morphological processes including ecosystems structures and how they function and how they managed to persist in an ever-changing environment over the years. Taking that into account it can be noticed that a coastal zone is a dynamic landscape which needs special treatment. It also needs adequate solutions which will be helpful to preserve the land and to create a safe environment for all users.

2.1 Interaction of various factors

When analysing the coastline zone in North Poland, first it is necessary to examine the condition of this zone. As we delve into the specifics of a coastline whose geographic length is 524 km it should be noticed that the area of this zone consists of different structures 'Figure 1'. There are two types of coastline: accumulative type and cliff type. Therefore, one can find sandy beaches, dunes and cliffs of great heights, and slopes which form about 1/5 of the Polish coastline [2]. There are also characteristic forms of rivers' and lakes' spits. Scientists studying coastline dynamics of the South East Baltic region note that during the period of the last 100 years there was a slow loss of land areas [3]. Furthermore, the rate of erosion has been increasing steadily along the entire length of the coast for the past two centuries or more but the pace of change has quickened over the last three or four decades [4]. On the basis of these studies it can be assumed that the South Baltic coast is increasingly threatened through higher and still rising sea levels and extreme weather conditions with more frequent severe storms. Their number and duration with wind speeds in excess of 15 meters per second is an important element influencing the living conditions in this zone.

Nevertheless, it should be noticed that the environmental and landscape richness, as well as diversity of the Polish coastal area, makes it an attractive region for residents and visitors alike. Despite many impacts and risks, human presence and activities are very intense there. The coastal zone is urbanized and inhabited to a large extent. Particularly, river estuaries are intensively settled, creating densely populated areas. Characteristic for this zone is the emergence of tourism which has led to increased development of coastal infrastructure. Constantly there can be observed an increase in built-up areas and enhancement of tourism intensity as its consequence [5]. The number of people moving to the coast causes a demand for housing and the attendant infrastructure. Therefore, there must also be provided the opportunity for employment and recreation. It can be noted that in the coastal area there are many communities with new coastal residents.

However, observations made in recent years show that the low-lying parts of the Baltic coast protected by sand dunes are being weakened, with the dunes partly damaged and therefore becoming ineffective. It can mean that irreparable changes can bring the loss of land and the abandonment of exposed sites. Regarding this there are many problems which exist in such zones which still are being

discussed. One of the major problems is whether to introduce artificial barriers and flood defenses or to allow nature to take its course. It would mean significant restrictions on land use and urban development.

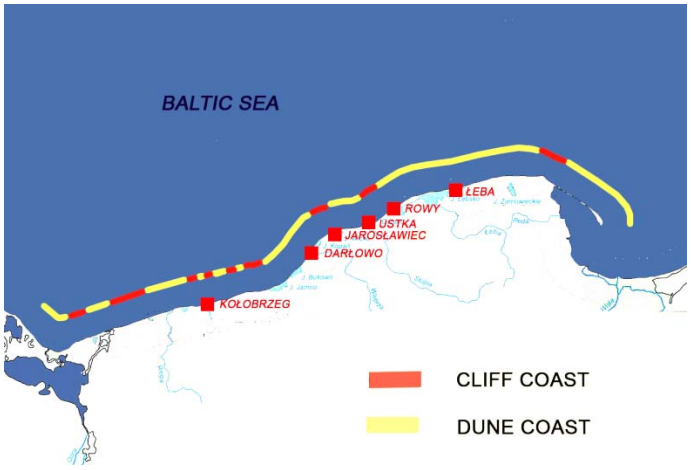

Figure 1. Coastline zone in North Poland - types of coast along Polish Southern Baltic Sea scheme

2.2 The legal status of maritime boundary protection

Considering the problem of reshaping of coastlines it is also essential to recognize the legal requirements for coastal management. Any intervention taken in the coastal zone should be consistent with an Act pertaining to the maritime areas of the Republic of Poland and the maritime administration dated 21 March 1991 which is the main legal instrument that regulates Polish maritime zones. There are also special programs and strategies which are prepared in order to obtain a sustainable state in the coastal zone, as for example, the long-term "Coastal Protection Program" established by an Act of 28 March 2003. Analysing the legal frameworks it is also necessary to mention the Operational Programme Infrastructure and Environment which is the instrument allowing for the implementation of coastal interventions. It is also important from a scientific standpoint to study the environmental protection issues. For instance, the creation of Special Protection Area Nature 2000 became a warrant to protect highly valuable parts of nature. Thus, many aspects must be taken into account and only reconciliation of all requirements can be the right attempt to achieve sustainable solutions.

2.3 Regarding the human scale aspect

What is also important, nowadays there are many human beings who are looking for a place offering constant contact with water. Visual and haptic contact with water is needed by most of the population. However, because the creation of visual connections is one of the factors determining the quality of a coastal zone, the haptic contact with water is the most expected. Trying to determine the role of coastlines modifications in coastal settlements changes, it is necessary to examine pedestrian paths connecting to water. On the basis of this analysis, it turns out that modifications of a coastline's form can also play an important role in complementing continuity of public spaces. It has already been proven that this continuity is extremely important for creating a coherent urban structure. Important observations are made by Lucyna Nyka who emphasizes that transformed waterside areas may even become a crucial element of the public space network [6].

It can be pointed out that new parts of circulation paths that lead to water provide a unique opportunity to build relationships between settlements structures and water. In many cases designing such extensions is significant and helps strengthen the links of public space grids. Many architects believe that the integration of the waterside with the structure of the city focusing on pedestrian paths is the first step to a successful conversion of different areas [7]. Such interventions can very often be the beginning of sustainable development of existing settlement structures. Detailed analyses of

transformations reveal that walking paths running along the edge of the water and providing access to the water are pedestrian movement generators.

3. Case studies

Treating these connections as important factors were planned for the changes that took place in the structures located in Kołobrzeg and Jarosławiec. Investment in Jarosławiec was an intervention which lead to achieving the continuity of existing public spaces toward the water. The public space network was completed and based on continuity by way of creating paths for pedestrians. There was a need to improve pedestrian connections using existing outlines of the public space system. New forms of boundaries between land and water which are being shaped as hydro-technical constructions are at the same time important parts of the recreational public space network. Therefore, the goal of the building structures was to connect new paths with existing ones. In each case attractive public space became an important element that linked the newly created pedestrian paths with the surrounding structure. It can be also observed that new forms of structures which help to save the land were designed there to provide visual contact with the water. The pedestrian paths designed using new forms of shore defenses contributed to the fact that reconstructed and new beach areas have become the most important accessible parts of public spaces structure.

It can be noticed then that interventions realized in recent years which were helpful to save the land, also brought in new spaces for recreation. They improved the conditions of spaces along the coast. Moreover, these interventions were the starting point for transforming adjacent areas. In analysed cases new compositions of pedestrian connections with water are being created. It can be seen that these interventions significantly change most of the areas visually and functionally cut off from the water. At the same time, they help to improve the quality of life.

Figure 2. Repair and extension of the boundary band in Jarosławiec – as an adaptation to changes in sea level and weather conditions; state before and after intervention, [8].

In the transformation project based on the concept of a new port for Ustka, new public spaces are connected with the existing system creating its extension and the continuity of public space network. It is worth noting that the idea to modify the breakwaters system of this structure aimed to improve the functioning of the port. Due to this intervention the former port areas will be transformed and opened to public use. The analyses confirm that to achieve the best results it is worth planning the layout of public spaces consistent with the areas located in the neighbourhood. The concept of the transformation of this zone follows such an approach. In this case, the area of the beach is linked with the city centre using pedestrian paths. The east part of the planned hydro-technical structure extends pedestrians paths towards the seawater. This is a solution which is used to create the illusion of sailing away to sea.

Figure 3. Kołobrzeg – underwater hydro-technical construction which allows to re-form the beach; state before and after intervention, [8].

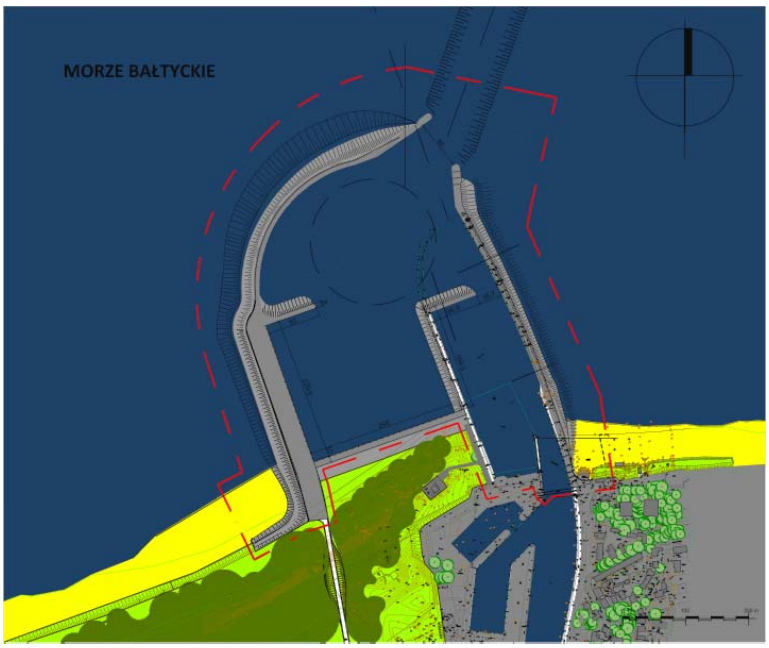

Figure 4. Ustka – the proposal to shape the elements of new port concept of new port /scheme of the designed construction as a part of public space network, [8].

The Ustka structure transformations projects show how important it is to create a safe coastal zone. This is also a model of hydro-technical forms, which ensures visual relationships with water. The presence of water is seen even from places not only located near its edge. It was possible to take full advantage of this zone by leading the main pedestrian path to the beach and by creating an overhead walking structure whose main role is to protect the city structure during storms.

Other analysed cases are the transformations of the coastal zones in Darłowo, Sarbinowo and Rowy. İn these interventions the author has presented an approach that promotes access to water from any place and with any function, emphasizing the links between the different areas located by the water and farther from the coastline. The new form of the coastline has become the most important element of the proposed concept for creating a new recreational area in an existing public spaces system [9]. It was also an opportunity to introduce new services essential in the coastal zone.

Moreover, due to the way of shaping the form of the coastline and its strengthening, all cases are examples where new development is planned which arises from the needs and the principles of sustainable development. One of the effects of this part of coastline transformation are elements created in the form of terraces falling towards the beach and water, always allowing access to the water. These elements are important points of the open space network. By maintaining the flexibility of the created system it can be adapted to unforeseen weather circumstances.

Figure 5. Coastal area in Sarbinowo – the transformation project of coastline strengthening by Adam Borodziuk, [8].

These interventions changing the coastline outlines can be the basis for transformations of the existing structures. Providing the high quality of space, they are the starting point for changing the intensity of their use. The way they are shaped ensures the connection of the transformed zones with their neighbourhoods, with existing and new architectural-urban structures. This objective is visible in most of the examined cases. Furthermore, in the zone in which such an approach has been applied it can be observed that the city structure has started to be transformed. It is visited much more often than it was before. The main part of this zone is available to everyone regardless of the weather conditions and the time of the year. It is expected that this investment will have consequences in improving the living conditions in all aspects: spatial and functional, environmental and social as well as in terms of economics.

4. Results and discussions

Strategies concerning the processes of re-shaping the coastline applied recently in North Poland show how important it is to prepare them by taking into account all aspects – environmental protection requirements as well as the needs of human contact with water. The analyses show that the arrangement of spaces in a coastal zone cannot be accidental, but should result from multifaceted studies.

Coastline dynamics of the South Baltic region within the analysed sections always was the factor that influenced development conditions. A coastal zone is affected by terrestrial and marine processes. Existing coastal zone conditions are not stable. In these cases, the contours of shorelines are still changing. They move towards land as the water level rises and erosion proceeds. For that reason it can be seen that human settlement in endangered parts of the coast without interventions can create a risk for the coastline and its inhabitants. Therefore, special strengthening of such structures there should be considered.

Recollected cases present a specific attitude which provides solutions capable for protecting the water's edge and providing observation of the coastal landscape. In designing the transformations of analysed parts of the coastal zone, the relations with water were the base elements for newly-created recreational space. It can be seen that modifications of the coast zone can also be made to obtain special visual, haptic and acoustic effects resulting from the movement of water. Discussed modifications are also proof that attractive places created within the waterfronts zones change the method and intensity of use of existing parts of the public space networks. The providing of unique experiences and comfortable pedestrian paths in coastal areas using special solutions for hydro-technical constructions helps to improve spatial-functional, technical and ecological conditions in living places situated along the water. The changes of the water boundary forms which are shaped as land-saving constructions resistant to storm waves and periodic flooding helps to create high quality of public spaces providing access to water. It can be noted that the proximity between water and alternative pedestrian paths are undoubtedly advantages for the modified shore zones. Moreover, they can be perceived as the way to achieve much better linkage between the coast and the existing public space network.

Such solutions show how to build hydro-technical constructions creating at the same time sequences of pedestrian paths having constant contact with seawater. These solutions utilising pedestrian paths are significant for achieving a public spaces network which gives the possibility of best choosing the paths and their destinations. Their presence opens the opportunity to correctly choose the path and the places of rest which is an important goal for the coastal area. They enlarge the area open to the Baltic Sea.

5. Conclusions

The research helps to identify the relationship between the modifications of coastline forms and the changes in settlement structures. It can be seen that different types of coastal systems and structures need different approaches. Each case needs to be studied very carefully when the aim is to find the best solution which will be able to fulfil the protective and utility functions. In analysed structures, the important role of new shorelines forms in coastal towns and even smaller settlement structures development is apparent. Such investments can be the beginning of complex interventions in coastal settlement structures. They may be the starting point for spatial-functional and social transformations.

Problems concerning relations between coastal forms and public spaces of coastal zone settlement structures identified in this article should be further studied. It can be noticed that such relations need to be examined also, among other things, from environmental and economic points of view. What is important, all interventions should also be considered in relation to these issues. There is a need to emphasize the importance of awareness of preparing multi-criterial analyses and studies.

The analysed cases show that in such a sensitive area as a coastal zone all interventions which will allow its use in a most successful and acceptable way require compromise. To create the best solutions, the cooperation of hydro structures designers, architects, and urban designers is essential. It should be emphasized that there is a need to create quality standards for the design of such structures which should be a part of facilities in coastal public spaces.

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