



“Le Silo, Marseille, converted into a concert hall.
Architects Éric Castaldi, Roland Carta

Potential for architectural adaptation port silos

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Old ideas can sometimes use new buildings. New ideas must use old buildings.
Jane Jacobs.

Abstract: Post-industrial port structures occupy significant territories and play an important role in the architectural environment of port cities. Constantly changing social needs predetermine the search for new ideas and approaches to the reintegration of the former port territories and structures. The general tendency to preserve the integrity and successive development of the urban environment is the rejection of demolitions, unpromising losses from the standpoint of ecology, culture and economics. Architectural adaptation of a unique historical form (from an individual object to a territory) contributes to its integration into the urban infrastructure; is the art of connecting past and present. The article analyzes the potential of the combined urban planning and architectural value of historical silos as integral elements of port areas, with the aim of their reuse and sustainable development. The catalyst for the search for new ideas for filling, for a vivid imaginative solution of the “space of the future” is the characteristics of port engineering and technical structures (silos, warehouses, berths, cooling towers, etc.), their town-planning value. The overlap of different moments in time stimulates social interaction, forms the “spectacularity of opportunities”, a creative industry. The paper considers the trends and methods of adaptation (transformation, smart reuse) of port territories and silos into a dynamic sustainable environment.

Keywords: port heritage; silos; architectural adaptation; material flexibility.

1. Introduction

The architectural heritage is a unique resource of knowledge about the past of mankind - about society, history and culture. According to the architect-philosopher J. Pallasmaa, in the modern panic striving for everything new, we rarely stop to listen to the “implicit wisdom” of architecture (Pallasmaa, 2013). Smart technology can be lost forever. Preservation of the “nature” of historical material structures, the integrity of the urban environment can ensure the continuous sustainable development of all its constituent elements (De Gregoria, 2019). The paradox of the movement to preserve the natural and cultural heritage in world practice is characterized by a combination of progressive and conservative ideas, retrospective thinking and vigorous activity to create a modern urban environment.

The best way to protect a historical structure is to incorporate it into active modern life. Renaissance, re-use of historical forms is a way of preserving the very essence of history, enclosed in material structures. One of the recognized ways of updating the existing urban environment is the adaptation (smart reuse, rehabilitation, renovation, recycling, redevelopment, conversion, retraining, etc.) of its historical elements for actual social needs, that is, their valorization. Only new ideas and social needs can change the potential of the limited resources of the collapsing historical environment, turning the little worth into the invaluable.

The myth of the so-called “lost” post-industrial territories, “unnecessary” buildings and “outdated” engineering and technical structures of ports has been successfully dispelled by the practice of their rehabilitation and reuse for modern purposes. “Forgotten” malls and warehouses are successfully turning into modern public spaces, unexpected cultural clusters. A wide range of social activation of the post-industrial heritage is presented by examples from the regeneration of significant areas of depressed areas for amusement parks to the adaptation of various means of transport to mini-hotels. It is necessary to realize what has been done and continue the search for new ideas for the modern use of port engineering and technical structures, in particular, silos, their adaptation to constantly changing social needs.

Silos (*special structures for ensiling and keeping plant feed, as well as unprocessed grain or cement*) contributed to the development of large-scale trade, the successful formation of a number of port cities, and over time became one of their symbols. Unfortunately, they have also been the scene of many tragedies in the form of explosions and violent fires (Witter, 2010). At the beginning of the 20th century, 100 and more vertical cylinders of “incredible

mountain-like” elevators in Buffalo and Chicago made an indelible impression on the architect E. Mendelssohn (Figure 1).



Figure 1 | Chicago. Photo by E. Mendelssohn.

He published a series of photographs of port infrastructure, emotionally defining it as “a random confusion amid the chaos of loading and unloading ships, railways and bridges, crane monsters with lively gestures, hordes of silos in concrete, stone and glazed brick” (Mendelssohn, 1926). In “Toward in Architecture” Le Corbusier called the American elevators “the first fruits of a new age” (Figure 2).

However, these mega structures, which were originally called “mechanical miracles”, have lost their relevance, but they continue to play an important role in the composition of the city. The European ESPON program focuses on the reuse of industrial facilities, based on the fact that this is a problem of circular architecture. (Carman, 2019).

The purpose of the work is to identify the potential of unique engineering and technical structures - port silos for adaptation to various functional processes based on the analysis of international examples. The research



Figure 2 | Red Hook Grain Terminal, New York.

objectives are: to consider the aspects of the historical and architectural, urban planning, functional, material values of the silo towers - "living" symbols of the port cities; to identify trends and techniques for adapting and reconstructing historical silos for complexes with a diverse range of infrastructure and activities.

2. Materials and methods.

The methodology of this work (from *the Greek* *methodos* –the way of research) is based on an integrated and systematic approach, consideration of innovative, formative, architectural and planning issues in conjunction with social, urban planning, environmental and economic aspects of the problem of adaptation of historical structures, and also includes the systematization of theoretical research and design development, analysis of statistical data, study of literary sources to restore the integrity and modern use of post-industrial port territories and facilities. The organization of space in architecture is determined by the content of the projected activity. The usual path of architectural thought is from function to morphology. When designing in a historical environment, this stereotype breaks down, since the task is opposite to the traditional one. Instead of creating a space that most fully corresponds to a particular type of activity, it becomes necessary to search for functional content for an existing environmental object (micro-, meso- and macrolevels). The solution to this problem implies the process of combining the actually existing and conditionally necessary spatial structures.

The design features in a historically established urban environment determined the methodology and sequence of this theoretical study:

- study of an object in the totality of its properties and connections, determination of its total value (the principle of a systematic approach); - analysis of actual needs and feasible activities (design requirements);
- systematization of trends, possible methods of compositional transformation of spatial characteristics of all components of the port environment as a result of their filling with new content.

The focus of existing theoretical developments is a two-way search - from a specific social order to empty historical forms of varying degrees of value (Sahraian, et al., 2017) and, conversely, from specific types of historical fund - to the selection of actual content. The processes of shaping are considered as the processes of completing and changing the sign-information systems of a given cultural environment or era (Jacobs, 1961). Many researchers strive in their recommendations to find a

balance between reconstruction measures in the context of modernization, restoration and adaptation of historical structures (Giuliani et al., 2018). Much attention is paid to the consideration of aspects of sustainable development of post-industrial coastal zones (Gunay et al., 2011) and their elements; regional features of their adaptive use and modern content (Yu et al., 2012). When considering the revival of post-industrial zones and objects, the main attention is paid to the prospects for the development of tourism and recreation, large-scale office and residential projects (Kevill, 2013). An analysis of the methods of social adaptation of empty warehouses and port factories for cultural events is being carried out. The results of seminars, conferences on the study and documentation of heritage, as well as joint training of students with foreign colleagues are published in scientific collections (Yeksarova, et al., 2016).

3. Urban planning aspects and adaptation tendencies of port territories

The historical environment is not just a part of material culture, it is a kind of historical, functional and artistic integrity. Any intrusion into such an object should be based on a body of knowledge in the field of history, urban planning, art history, sociology and economics. The reuse of historical objects (at all levels of the hierarchy) should be subordinated to the idea of preserving their historical, cultural, aesthetic value in unity. In practice, the continuity of the properties of an object, its historical-functional-artistic integrity, as a rule, is broken - the unity of the historical with the functional or the functional with the artistic. One of the main challenges of modern use is to restore this continuity.

In the post-industrial era, many industrial areas and buildings were expected to be destroyed, lost, or irreversible. Thus, only one transition to containerized cargo transportation changed the original purpose of many port territories and facilities. The central location of industrial facilities, well-developed engineering infrastructure, high durability of buildings, relative cheapness of real estate at the initial stages became attractive factors for developers.

Modern urban development complexes on the site of the former industrial zones already have proven techniques, both in the field of architectural solutions and development approaches. An important part of the revitalization program of the port area of Marseille under the auspices of the state institution Euroméditerranée was the modernization and adaptation of the structure of the grain elevator, which is included in the list of "Heritage of the XX c." (Meinhold, 2013).



Figure 3 | V&A Waterfront in Cape Town.

In accordance with the city development model developed by Foster+Partners back in 1994, the inner harbor of the port of Duisburg is being systematically transformed, the post-industrial section of which was the largest transportation point from the Ruhr coal mines.

More than 12 historical warehouses, bunkers and mills of the port area have been adapted for offices, unique public facilities, and new buildings have been completed according to the designs of famous architects - N. Foster and M. Grimshaw.

The relevance of effective use of the historic harbor of Cape Town has led to the creation of a multifunctional Urban Focus Point on an area of preservation and incorporation of several historical structures, including the former granary (Wilson, 2014).

The long-term program for the transformation of about 4 million m² of the post-industrial port into a new district in the Nordhavn area (North Harbor) of Copenhagen initially envisaged the 123 hectares with residential and commercial real estate, shops, restaurants, cultural and entertainment facilities (more than 450 objects), as well as

the Zeitz MOCAA Museum in a grain silo. The Victoria and Alfred Waterfront, at the center of Cape Town's working port, has become the most visited destination (Figure 3).

The potential for adaptive reuse of "monuments of greatness" from another era is demonstrated by the project to create an extended world-class arts and culture center in Shanghai, which defined the landscape and appearance of the city (Yu et al., 2012). The closed volume of silos with a capacity of 80,000 tons is used for the main exhibition space of SUSAS 2017.

The formation of the so-called "emerging landscapes of consumption" in the context of competition for space and public access to water is supported by city authorities and businesses.

An integrated approach to the regeneration of such an important natural and anthropogenic source as the port territories contributes to the preservation of their integrity and successive development, as well as culture, economy, and environmental preservation. The rich history and atmosphere of industrial areas contributed to the rethinking of the material heritage and the creation of

unique multifunctional objects, confirming the economic feasibility of renovating stagnating urban areas. The landscape of port cities is the result of historical, cultural continuity, the development of an architectural heritage that is constantly changing over time and the development of society, which allows us to step back in time in order to continue moving forward.

4. Aspects of the historical, architectural, urban planning, functional, material value of the silo towers

R. Bofill's project in 1973 became a kind of catalyst for the rethinking of specific engineering and technical structures, including elevators, as well as a brilliant example of valorization of about 1000 m² of a former cement plant (30 towers and machine rooms) for an architectural workshop and the La Fabrica residence (Bofill R., (1988). Private housing and public functions ensure comfortable operation and ensure the activity of the post-industrial structure throughout the day.

The subsequent adaptation of old docks, warehouses and port areas of London, Baltimore, Rotherdam to prestigious areas have become textbook examples of innovative branding projects. Further social and technological changes showed a huge potential for the development of post-industrial areas and their elements. In the process of urban renewal, the original function of industrial buildings fades away, but the volume itself continues to belong to it, and the rationality of the building logic captures the imagination and vividly demonstrates its strength in the urban landscape. D. Heymann, in his study of the architectural and sculptural presence of the silent towers in the landscape, defines their meaning as "campanile of the American Midwest." He also noted the paradox of the presence of these dynamic aggressive forms that support, rather than violate, the integrity of landscapes (Heymann, 2013). In accordance with the approaches to determining the value of A. Riegl monuments, the monumental forms of elevators can be classified as "unintentional monument (Ungewollte Denkmal)" (Riegl, 2021). They are really monuments of their time, engineering thought, technology and materials.



Figure 4 | Foyer of the Silo d'Arenc, Marseille.

At the beginning of the last century, the silos in the port of Marseille revolutionized grain handling and handling technology. For almost 30 years, the elevator in the port remained abandoned, and proposals for its demolition were considered. Re-design architect Silo d'Arenc R. Carta noted that "the building showed terrible morphological and structural resistance due to load-bearing cells and acoustic resistance of concrete", while inspiring the idea of original versatility in adaptive use (Figure 4). The ceiling of the main lobby is formed by preserved inverted cones, through which the grain was fed directly into the trucks. The raw concrete of the octagonal "limbs" of the historic structure lends a unique design to the "udder room". Since 2011, the second life of one of the symbols of Marseille began, in the womb of which, in complete harmony with the traces of the past, the opera and pop music hall for 2200 seats began its creative life (Meinhold, 2013).

The most important tasks of combining a real shape with "ideal" requirements are the identification and evaluation of the shape, the association of its geometry and quality characteristics with the program of new filling.

Copenhagen is also home to another silo conversion, although here architects MVRDV had little need to hide the original grain silos.

The reconversion of the port buildings to accommodate dwellings manages to combine the modern lifestyle with the inherited industrial character. Hanging the apartment outside the silo allows for the creation of curved wide uninterrupted terraces along the glass façade, providing space designed to maximize the spectacular panoramic views of the harbour (Figure 5).

The harbor of Copenhagen has become a suitable place for new residential developments. The studio COBE converted the cellular spaces of the Copenhagen elevator into a 17-storey residential building with 38 unique units ranging from 106 to 401 m². The transformation process into multi-storey apartments required the creation of openings for windows and balconies around the entire perimeter and height of the tower's concrete facades. "We wanted to preserve the spirit of The Silo as much as possible - both its monolithic appearance and the majestic concrete interior, simply by draping it with a new coat," said Dan Stubbergaard (Griffiths, 2017).

North Harbour is the first urban area in Denmark to have achieved the highest possible sustainability certification in accordance with the DGNB standard.

The aerated concrete structure of elevators, which meets stringent technological requirements, at the same time limits the possibilities of filling it with new content

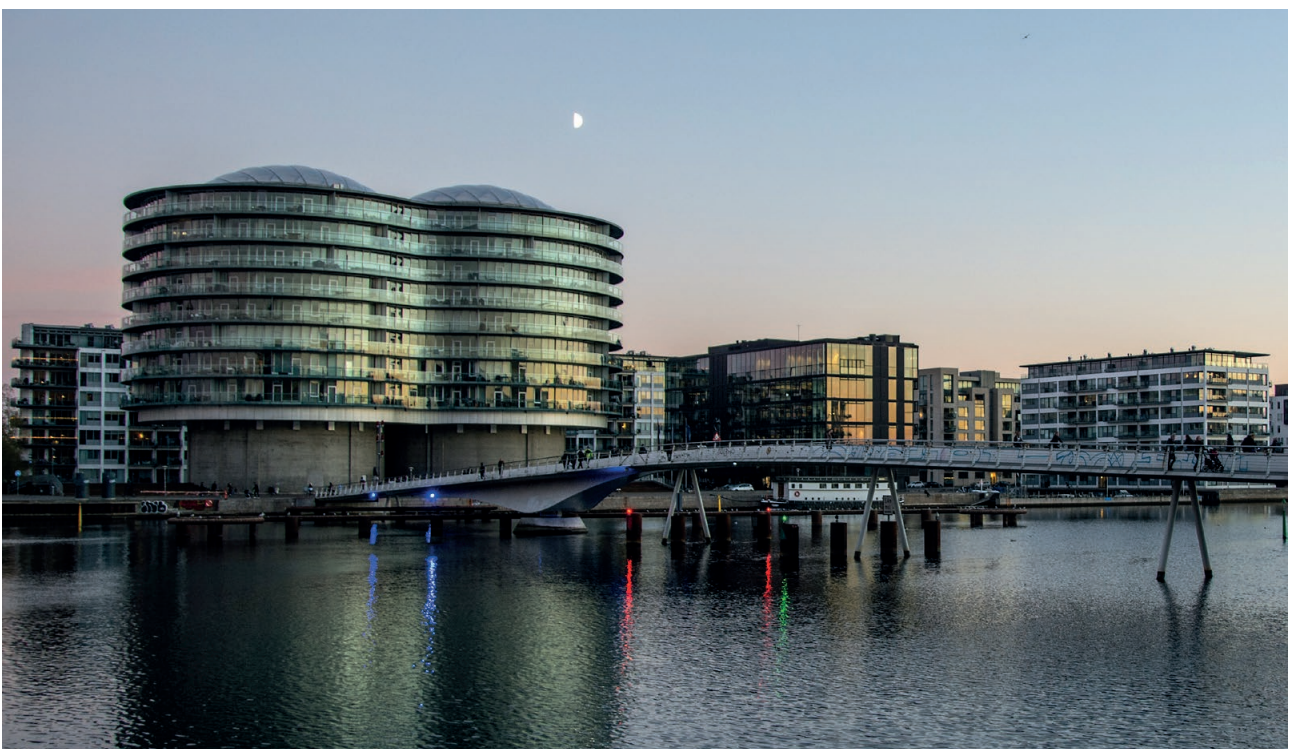


Figure 5 | Silo. Copenhagen Harbor, Denmark.



Figure 6 | Light through the slots of the Zeitz Museum of Contemporary Art Africa (MOCAA), Cape Town.



Figure 7 | The pillowed glass glazing panels in the façade, Zeitz MOCAA silo.

and inspires to search for adaptation methods. Architect T. Heatherwick creatively rethought the transformation of the 42 tubes of the grain bin complex into exhibition halls. “Rather than strip out the evidence of the building’s industrial heritage, we wanted to find a way to enjoy and celebrate it. We could either fight a building made of concrete tubes or enjoy its tube-iness.” (Frearson, 2011).

This dilemma of transforming the 8 central honeycomb structures into the spiraling communication space of the Museum of Contemporary African Art by Heatherwick was solved by using cutting-edge concrete section cutting technology.

This made it possible to create a grandiose atrium with a bright chemistry of intersecting spaces, geometry of oval shapes, and play of light (Figure 6). The remaining silos house 80 galleries for the Zeitz MOCAA permanent collection and traveling international exhibitions, 18 educational sites, a rooftop sculpture garden, a modern storage facility and a nature reserve. A full range of services has been designed for a public institution of this magnitude, including bookstores, restaurants and

bars, cafes, fellows’ rooms, and various reading rooms. Traces of the past are also integrated into the design of the Luxury Royal Portfolio hotel, located six floors above the museum. And the convex glazed frames of the upper floors actually turned the renewed volume of the granary into a luminous beacon in the evening (Figure 7). Based on modern standards, the facade cladding is made of galvanized steel, which, thanks to the sea air, will quickly become patina. The sculpted surface with the new “skin” protrusions creates a play of shadows and protects from direct sunlight and wind.

5. Perspective programs for filling the port heritage

Renewal and preservation of the port heritage should be based on the preservation of its cumulative historical and cultural value and imparting modern meaning. To eliminate certain contradictions, conflict between the concept of “renewal” and the principle of preserving “identity”, it is important to search for a compromise, a balance of interests.

The basis of the project concept of adaptation is a complex solution based on a simultaneous comprehensive analysis of the characteristics of the historical form and the needs in new institutions. The correspondence between the real historical and the required ideal spatial structures can be achieved by fulfilling a number of aesthetic, ecological, urban planning, functional, requirements for turning the port territories into a part of a thriving community of a metropolis, creating an urbanistic focus between land and sea. It is recognized that the accumulation of creative industries, cultural organizations and places, and recreational facilities in urban spaces creates a vibrant urban culture that attracts a new wave of “creative tourists”. Many factors are contributing to renewed interest in coastal revitalization, celebrations and public itineraries. The creators and co-directors of the unique urban atmosphere are numerous participants, visitors to cafes, comfortable places for communication and recreation, in which life itself is “in full swing”.

6. Consideration

The socio-cultural value of the historical form becomes the main criterion when deciding the degree of intervention, various changes and restructuring. Based on the analysis of experience, the following main approaches to adapting the existing structure have been identified:

- preservation of the high socio-cultural value of the historical form (a monument of architecture and urban planning), full compliance with its qualitative characteristics. The monument actually predetermines the form of implementation of its new purpose (the principle of compliance with ethical and aesthetic aspects);
- partial redevelopment (rebuilding) if the existing structure has no significant value. Such intervention provides for the preservation of size and appearance;
- a radical restructuring of a historical building object that does not have a high socio-cultural and material value, the emergence of new elements (extension).

Social activation, adaptation of the port heritage turns ordinary or typical forms into a rare and even exceptional phenomenon. At a new historical stage, not only the historical form interacts with the modern content, but also the historical content with the modern one. The study showed that a sharp departure from the original function opens up unexpected and wider opportunities. The modern function reveals the historical form from a completely different side, contributes to its romanticization and theatricalization, especially when used for all kinds of cultural clusters. In fact, there is a “psychological” revaluation of cultural monuments. “

Reconstruction is the only legitimate approach to historical development, but not an end in itself. Practice shows that multifunctional complexes can be successfully inserted into a fragment, a zone of the historical environment with the help of a wide range of techniques and means. A fragment of historical buildings, mastered and included in the system of a modern city, from a monument of its era turns into a part of modern reality with the maximum preservation of its historical and artistic value. The challenge is to creatively transform all forms of architectural heritage. Its social significance and, consequently, the imaginative perception of the building are undergoing radical changes.

In the context of architectural adaptation, environmental design should ensure: the interaction of rational and artistic attitudes, deployed in time and by elements of the environment; the unity of the compositional transformation of the spatial characteristics of all components of the environment; the integrity of the imaginative content and the connection with aesthetic impressions from all components of the environmental complex.

7. Conclusion

The main object of the conservation strategy and the program for the renewal of the existing coastal environment should not be a separate building or ensemble, but a section of a holistic and continuous urban environment. Renovation of the port’s post-industrial areas is, as a rule, part of the logic of revitalizing and developing the coastal zones of the city. Architectural monuments, ordinary historical buildings and engineering structures are equally important for the cultural identity of the existing environment of port cities. The main task of reuse is to do “the thing again”, to propose a model adapted to the realities of the context in compliance with modern requirements and to obtain an effect for the whole area of the city. Reuse allows you to breathe new life into a crumbling structure, with respect for its qualities. The transformed harbor areas, thanks to a resource of creativity and a diverse mix of functions (art galleries, concert halls, archives, libraries, residential, etc.), are becoming inspiring places for creative parks. At the same time, traces of the past are actively integrated into modern design.

The paper identifies the main methods of adapting the former silos to a wide range of multifunctional content: installation of interfloor ceilings; expansion due to add-ons, add-ons of new volumes; the device of a new “skin”; creation of hall spaces by inserting into cellular structures; maximum inclusion of features and details of the post-industrial form.

The main trends in artistic comprehension and transformation of symbols of the post-industrial era into symbols of cultural infrastructure are:

- creating a human scale and dynamic visual and communication links;
- achieving environmental sustainability using natural and climatic resources, innovative materials and technologies;

- creation of a vivid aesthetic image (atmosphere) of the environment based on the use of the emotional potential of the historical form of silos (methods of metaphor, hyperbolization and contrast).

These general conclusions can serve as a basis for further research on selected aspects of the adaptive use of the port industrial heritage for brand programs, taking into account the development of innovation, education and culture.

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