PUA 1/2019

DOI: 10.4467/00000000PUA.19.015.10018

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Trends in the formation of maritime passenger terminal architecture in intermodal transport systems using the example of the reconstruction of the passenger terminal in port Odessa

Trendy kształtowania architektury morskich terminalów pasażerskich w warunkach intermodalnych systemów transportowych na przykładzie przebudowy terminalu statków pasażerskich w Odessie

Abstract

This article considers modern trends in the of development of intermodal passenger transport systems as factors influencing the formation of maritime passenger terminals (MPT). The paper describes the main intermodal factors that influence the structure of passenger terminals: master plan, functional organisation and formation of internal space. The article is supplemented with proposals for the reconstruction of the passenger terminal in port Odessa and its further adaptation to intermodal technologies.

Keywords: marine passenger terminal, intermodal transportation, reconstruction, intermodal zone

Streszczenie

W artykule omówiono aktualne trendy w rozwoju pasażerskich systemów transportu intermodalnego jako czynnik wpływający na tworzenie morskich terminali pasażerskich (MTP). Opisano główne poziomy wpływu czynnika intermodalności na strukturę morskich terminali pasażerskich: plan generalny, organizacja funkcjonalna i tworzenie przestrzeni wewnętrznej. Artykuł jest uzupełniony propozycjami odbudowy terminalu statków pasażerskich w Odessie i jego dalszej adaptacji do technologii intermodalnych.

Słowa kluczowe: morski terminal pasażerski, transport intermodalny, rekonstrukcja, strefa intermodalna

1. INTRODUCTION

The history of the development of intermodal transport dates back around 130 years. It takes its origins from freight transportation, the cooperation of various types of cargo transportation, their unification and standardisation. Beginning in the nineteen fifties and sixties, with the commencement of container traffic, the development of intermodal freight traffic has become an important factor in the development of the world transport system (WTS). The next logical step in the development of the global transport system is the implementation of intermodal technologies within the passenger transport sector. The turning point in determining the beginning of the systemic implementation of intermodal transport at the state level in Europe should be considered to be the appearance in 2001 of the White Paper 'European transport policy for 2010: time to decide'. This document identifies a number of measures for the economic stimulation of intermodal transport, the development of new technological solutions, and the reorientation of promising European programs and transport infrastructure development projects on the principles of intermodalism[1].

In the context of European integration, Ukraine is also trying to modernise its transport system with global trends, which is specified in the state program for the development of the transport industry – the National Transport Strategy of Ukraine for the period to 2030. Moreover, Ukraine is located in the crossroads of transport corridors within the Black Sea Pan-European Transport Zone, which, according to the EU Motorways of the Sea concept, is a priority for development. Within the above-mentioned corridors, the main ports of Ukraine on the Black Sea are Odessa, Ilyichevsk, the port of Yuzhny, and the port of Izmail. All the above create prospects for the development of Ukraine as a transit state.

Existing studies of the intermodality and multimodality processes of passenger transport systems by many authors have confirmed the removability of the typological series of transport objects and the inevitability of occurring of their new type. In their works, the aforementioned authors substantiated the emergence of a new typological unit – the passenger terminal as an element of the intermodal passenger transport system[2]. They found differences in the terminal from other passenger service facilities within transport infrastructure: stations, transport interchange hubs, public transport centres, combined stations for several modes of transport. Among the main distinguishing features of modern passenger terminals from other types of objects is the provision of quick passenger transfer from one mode of transport to another and the mandatory dominance of the transport and information function with the possible development of public ones[3]. It is also mandatory to distribute transport over multiple levels and provide vertical links of side platforms of various types of transport.

2. WORLD EXPERIENCE IN MIXED PASSENGER TRANSPORTATION

A peculiarity of any voyage is the need to use different types of transport, thus the whole modern world has become a system of mixed (intermodal or multi-modal) traffic incorporating various modes of transport. The main task involved with mixed modes of transportation is the optimisation of travel through the transfer of passengers from one mode of transport to another. But if we consider urban conditions, the task is to minimise the use of personal cars with a reorientation of passenger traffic to public transport. The driving force behind the widespread planning of travel across various modes of transport is up-to-date online systems and mobile web applications for personal devices.

There have already been attempts to create local prototypes of intermodal passenger systems, for example, the Lufthansa and Deutsche Bahn alliance. Lufthansa Airlines, with the support of Deutsche Bahn, offers international passengers the opportunity to reach, by train, any German airport from where Lufthansa airplanes fly. If there is no possibility to reach the airport by the Deutsche Bahn train, the Rail & Fly service offers the use of regional public transport. Another example is the government-owned Italian rail transport operator Trenitalia, which offers the Frecce and Bus service. A single travel document enables you to get to small towns where there is no train connection. One solution combines the high--speed option Frecce – trains of various classes, which run at maximum speed of 200 to 360 km/h – and a low-speed option, which is the Freccialink bus service.

With regard to maritime passenger transport, it has always been intermodal, even before appearance of this term. People moved from wagons to ships or ferries on waters too deep to cross, changing one mode of transport to another. One example of the historical formation of such terminals is the Hoboken Terminal in Hoboken, New Jersey, built in the United States in the early 19th century to ferry passengers from New Jersey to New York (Manhattan) across the Hudson River. Subsequently, when the subway line was built under the Hudson 'PATH' (Port Authority Trans Hudson), the subway station was also incorporated in the Hoboken terminal. Even later, to unload the subway, the Hudson-Bergen Light Rail (HBLR) high-speed tram line was built with a stop at the terminal. Furthermore, the terminal is a hub of several bus lines. The ferry service has recently been revived. Thus, the Hoboken terminal is an important node of the city transport system. Another example of the combination of sea and air transport is a terminal in Hong Kong (PRC). The Hong Kong International Airport has a direct ferry line to link the airport with various destinations in the Pearl River Delta – Zhujiang. This type of transport is available only to air passengers. Passengers who use the ferry are considered transit passengers. For this reason, access to the ferry terminal is arranged prior to immigration and customs control, in fact, as a transit from one flight to another. The airport is well connected to the motorways and the Airport Express subway line. In the near future, other seaports and logistics facilities will be added

here. Another example from Japan is the combination of air and marine transport at Kansai International Airport[4], which is a ferry that provides a connection to Kobe Airport.

The advantages and convenience of modal transport are indisputable, and this is why the system is now experiencing a new phase of intense development. Let us now consider the ways the intermodal processes affect the formation of the structure of maritime passenger terminals through the reconstruction of the maritime passenger terminal in the seaport of Odessa (Ukraine).

3. MARITIME PASSENGER TERMINAL IN ODESSA. HISTORY OF DEVELOPMENT

The passenger service complex of the port of Odessa is the most modern in Ukraine. The maritime passenger terminal was built here on the New Pier in 1968. Among many competitors in the Stalin Empire style, the 1960 project by architects V.P. Golovin and V.K. Kremlyakov won the contest. The building in the constructivism style was light, concise, and penetrable by light and air. The main works were carried out before 1967: the New Pier length was extended by 70 meters, and a huge warehouse complex was built in its substructure. After completion of the passenger terminal construction, the New Pier was capable of simultaneously accommodating both passenger and cargo ships. Cargo cranes operated on the pier, and railway tracks ran along the quays. For the convenience of passengers boarding liners, mobile side-ladders were used. In addition to the maritime passenger terminal, the entrance pavilion from Primorskaya Street (then Suvorov) with escalators was simultaneously built, and the line of the old funicular that ran along the Potemkin stairs was replaced with the then modern escalator. A bridge-overpass was also constructed above the railway tracks of the Odessa-port railway station.

The Passenger Terminal service complex existed unchanged until the early 1990s. Subsequently, it underwent significant changes, and the terminal building was completely reconstructed. The first reconstruction was performed in 1992 by the Italian company “Tegola Canadese”. Now the terminal can accommodate five ships simultaneously, and its capacity has increased to four million passengers per year. Exits were added to the bridge as access to traffic was closed in the seaport at level of the berths. The warehouse was removed from the substructure floors which were partially connected to the operational space; for this reason, the ground floor was cut through and an atrium was arranged on two lower levels. Instead of warehouses, a huge concert and exhibition hall were arranged in the substructure, as was a yacht club. The exterior of the building was also changed. The hinged structure overhanged the main facade, and lightweight rooftop galleries were turned into a full floor. A great constructivism pattern was actually destroyed. The building lost its laconicity and lightness and became unusual for this shape style. During the reconstruction, by the end of 2001, the St. Nicholas Church and a multi-storey hotel

complex were constructed behind the terminal on the hydrotechnical facility. The high-rise hotel building, originally belonging to the Kempinski hotel chain, was later removed from its control due to defects in the design. The hotel's location was rather controversial right from the start, and later it only proved its unprofitableness.

Another reconstruction is underway with the same intension as that presented above. In parallel with the arrangement of the 'open customs space' in the passenger terminal building, which was intended for processing sea cargo under an accelerated procedure, it was decided to replace the facades. Subsequently, the 'open customs space' was cancelled. However, in 2016, the elderly façade made from Italian glass was already dismantled and there was not enough money for a new false-façade. Project documentation has been developed by State Project Development & Research Institute of Marine in Odessa, but works remained unfinished.

Funds to complete the reconstruction were found only last year. In 2018, a new kinetic facade of several thousand metal plates moving with the wind and creating the effect of a wave was attached to the marine terminal. At the same time, the new facade became very static, and the building lost its initial swiftness[5].

As we see, proposals are urgent for an alternative approach to the reconstruction of the structure, which already has an architecturally historical value and can be adapted to intermodal technologies.

4. THE INFLUENCE OF THE INTERMODALITY FACTOR ON THE FORMATION OF MARITIME PASSENGER TERMINALS USING THE EXAMPLE OF THE ODESSA PASSENGER TERMINAL

The main influences of the intermodality factor on the formation of the maritime passenger terminals (MPTs) are the master plan, the functional-spatial organisation and the terminal internal space.

4.1. MASTER PLAN

The three main elements of the general plan of the passenger terminal have always been: berths and piers, the terminal square and the terminal building. Mixed passenger transport often focuses on one or more types of fast transit which are accompanied by low--speed options and urban transport at the beginning or the end of the trip. Thus, the above complicates the functional organisation of the terminal territory. The function of the terminal square partially passes into the terminal itself. Preference is given to a multilevel solution.

The basic requirements for the formation of a master plan for marine terminals are:

- clear zoning (the following basic areas are outlined: sea traffic zone, zones for occasional other types of external high-speed transport, suburban regional transport zones, urban public and individual transport zones);
- organisation of safe rapid main transport and pedestrian routes (ensuring the distribution of counter flows and eliminating the crossing of pedestrian streams with the routes of all modes of transport – pedestrian paths should be convenient and short, without unnecessary climbs and descents to be accessible to immobile groups of the population);
- terminal-city communication (as a rule, maritime terminals are close to the cities' historical centers because port cities have always been formed around waterways, so it is important to make the terminal zone accessible to passengers and visitors, to revive life in the areas cut off from the cities by the industrial-production zones, and to make the terminal the center of gravity of the city public life by creating the conditions for recreation and relaxation).

Let us consider how to translate these principles on a specific example. Odessa maritime passenger terminal is located in the centre of the city. The Potemkin Stairs from Primorsky Boulevard descend to Primorskaya Street, which runs parallel to the pedestrian boulevard, and is one of the main transport arteries of the city. The railway tracks run parallel to the pedestrian boulevard on a lower level, thus cutting off the coast from the city. A bridge leads to the pier above the railway tracks. The passenger terminal is mainly at the bridge level, which is two floors above the berths level, but to get to the bridge from the city, you must go down the Potemkin Stairs or take the cable car, go by the underpass under the Primorskaya Street, enter the entrance pavilion of the passenger terminal and walk upstairs to the terminal square – there was once an escalator.

As we see, the pedestrian traffics still intersect, pedestrians need to constantly go either upstairs or downstairs. Traditionally, preference is given to vehicles. In order to return the terminal area to the city, given that the terminal is in close proximity to its main historical and architectural monuments, it has been proposed to change the vehicular and pedestrian circulation. Priority should be given to pedestrians, the underground level earlier used by pedestrians should be given to transit vehicles from the Primorskaya Street and the ground level of the street should be given to pedestrians, thus creating a direct link and pedestrian accessibility in the area where people go down from the Potemkin Stairs which will create a new public space - the centre of gravity of the city public life. The road junction near the river terminal in Kyiv was organised in the same way. The lower level of the terminal has been suggested to be used by vehicles (buses, taxis and private cars) and partly for parking, which is now represented by an open parking lot.

4.2. FUNCTIONAL ORGANISATION

With the turnover of the typological series, changes occur in the architectural--planning structure. Unlike other objects of transport, in terminals with the development of infrastructure, the process of reducing large halls and waiting areas in terms of volume occurs due to improved information support for passengers and their baggage. Consider the basic functional model of the new typological unit – the maritime passenger terminal (MPT) (Ill. 7). It has been established that for passenger terminals of all types, the presence of a new specific zone (the intermodality zone, which is responsible for the distribution of passenger traffic) is decisive and represents a single information centre and a system of supply communications to berths and transport side platforms. Thus, the accents have changed due to the prevailing transport and information functions in MPT; the centre of the model is the intermodal zone, which is formed by, among other things, reducing the waiting area and long stay of passengers. Unlike the usual vestibule-distribution zone of the terminal, the intermodal zone of the terminal works on several types of transport at once, and thus requires a more detailed and accurate information of passengers and new approaches to the formation of internal space.

Returning to our example of Odessa, the atrium, formed during the 1994 reconstruction, is suggested to be expanded. It will form the core of the new functional scheme, the so--called 'intermodality zone'. Together with a set of new vertical connections, the zone is designed to unite all the technological levels and to provide access to various means of transport, such as underground parking for buses, taxis and personal cars, the level for main operating rooms and related services. The unprofitable multi-storey hotel complex is proposed to be disassembled. Instead, a business centre with a conference room, hotel rooms and a summer theatre are suggested to be located on the pier. At the existing hydraulic facility, entertainment events have already been performed on a temporary stage; therefore, creating a summer indoor theatre with a set of necessary facilities is relevant. A restaurant with a large amount of summer recreation areas is suggested for the roof of the main building. This will expand the set of options. The territory of the terminal, integrated into the city, will become a new centre of public attraction.

4.3. TERMINAL INTERNAL SPACE

In modern theory and practice, along with the process of complicating the internal structures of buildings and saturating them with a large number of functions, the term 'communicative space' is becoming increasingly common and confidently replacing the usual idea of internal space. This refers to space that is not hostile to its users, space that promotes communication, with understandable orientation and does not cause unnecessary stress. The main spatial idea of such an environment is the division into 'functional layers' – floors, levels, etc., providing the visitor with the opportunity, if desired, to move from

one layer to another, without losing the unity of visual perception and receiving all the necessary information in a full and timely manner. The interior is a dynamic information space that communicates with the person. According to A.V. Lobanov, among the already formed practical techniques that are implemented in communication spaces, the following items can be identified:

- visual delimitation of 'layers' of spaces with an obligatory set of interrelations (they allow the structure to be a 'dialogue' one), as well as with a 'unifying space', which is also a link;
- visually and psychologically pleasing due to the exclusion of functional monotony;
- preservation of the unity of space perception and a modern means of zoning space – lighting, technological equipment, visual aids (colour, geometry, texture) are used instead of partitions and walls;
- aesthetic perception (depending on the specific communicative space – if it is a space for getting information, then the perception is concentration, if it is a space for leisure, then the perception is relaxation);
- ensuring the dynamics of perception (the building itself seems to guide the user in order to focus and inform them in the most clear and quick way, given the speed of movement and the importance of information)[6].

As we can see, the internal systems and the functional organisation of the new terminal in Odessa will become more complex, and effective management and use of these functions will be an important condition. Therefore, the following is suggested for the organisation of the communicative space:

- visual separation of the layers is achieved by the vertical placement of the technological levels – vertical connections between these levels are necessary, providing a technological sequence of passenger services;
- preservation of the uniformity of perception due to the central unifying space – in our case, it is an intermodality zone, combining the levels formed by the atrium and helping to quickly guide and inform the passenger;
- the interior does not allow the gaze to strain or dwell on one thing – the space is scalable due to the smoothly flowing spaces (along with their colouristic, geometric and tectonic solutions), as well as functionally thought-out equipment and electronic facilities (reference computer modules, monitors, etc.).

4.4. IMAGINARY SOLUTION

Based on the said practice of the reconstruction of the marine passenger terminal, the main idea of the imaginative solution of the new terminal will be the preservation of its historical value, specifically with regard to clearing the primary structures and achieving maximum approximation of the historical appearance of the building according to the 1968 project in the constructivism style. To this end, it was proposed to clean the main facade and

the superstructure, to disassemble the hotel complex, which is mainly unprofitable, to return it to the 'clean style' as much as possible, even to reproduce the pattern of stained glass imposts.

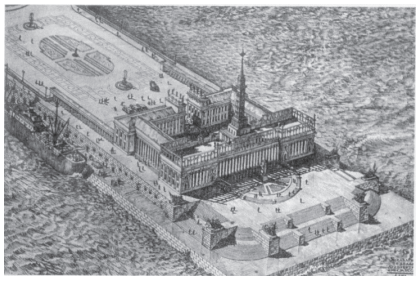
It must be admitted that, compared with modern passenger liners, the terminal construction looks small-scale. Therefore, it was proposed to cover the building and most of the hydraulic facility with an interactive shell that completely changes the scale of the complex (Ill. 9). Its form resembles a sea creature that has emerged from the sea. This is a huge bionic design with front video media grids that present a variety of media content, including video images, graphic information and animation. Thanks to program management, it is possible to create an unlimited number of programmable scenarios. A thin LED profile is attached to the back of the grid creating a flat surface that is transparent to the sun's rays, so the design simultaneously serves as an effective sunscreen. Furthermore, due to the smooth flow of lines, all elements of the passenger complex will be combined. The design does not have a clear separation of the roof and walls; therefore, due to smooth ramps, new scenarios for the use of public space will be created, new walking routes for passengers and the city guests will be mapped. This will create a new interesting public space filled with new functions.

5. CONCLUSIONS

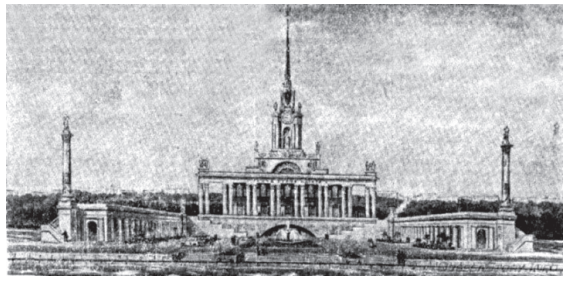
In conjunction with measures aimed at improving the quality of passenger service, comfort and technical equipment of vehicles, the construction of passenger terminals will increase the priority of using these types of transport (the demand for which fluctuates or falls) and reduce transportation costs. The creation of an intermodal passenger transportation system in Ukraine, in particular, with the creation of passenger terminals for several types of transport on the basis of existing maritime terminals, is designed to solve the current problems of modern sea transport facilities; to breathe new life into the mostly abandoned passenger seaports from Soviet times; to carry out renovation of port areas, and transform terminals from sensitive sites with limited access to attractive recreation areas of urban significance with the key facilities of a multi-level transport system.

Of course, the construction or reconstruction of this type of structures must begin with a comprehensive assessment of the transport system of the city and the region in general, the possibilities and feasibility of cooperation of these or other types of transport, with the formation of the economic, legislative and social base for the development of intermodal systems. The proposed principles of the architectural and planning organization of marine passenger terminals, the redistribution of areas of the main functional areas, as well as the principles of the formation of internal communication spaces can be used both in new construction and for the reconstruction of already existing marine stations. They are designed to adapt the facilities for passenger service of sea transport to modern trends in the development of transport systems, to facilitate quick navigation and comfortable stay of passengers.

A



B



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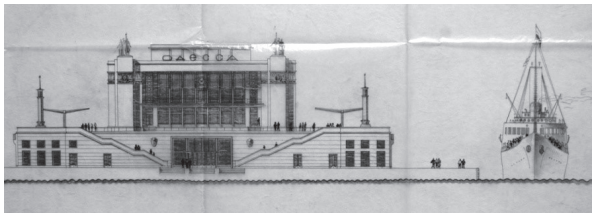
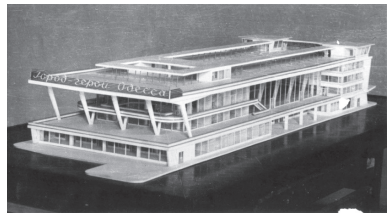


E



Ill. 1. Before the construction of the terminal. A – Project/draft of the marine station. A fragment of a panoramic city development plan (architectural competition in 1952). B – draft of the marine station (architectural competition in 1953). C – draft of the marine station (architectural competition in 1958). D – draft of the marine station (architectural competition in 1958). E – implemented project of the marine station in 1960, arch. Golovin V.P. and Kremlyakov V.K. (Model)

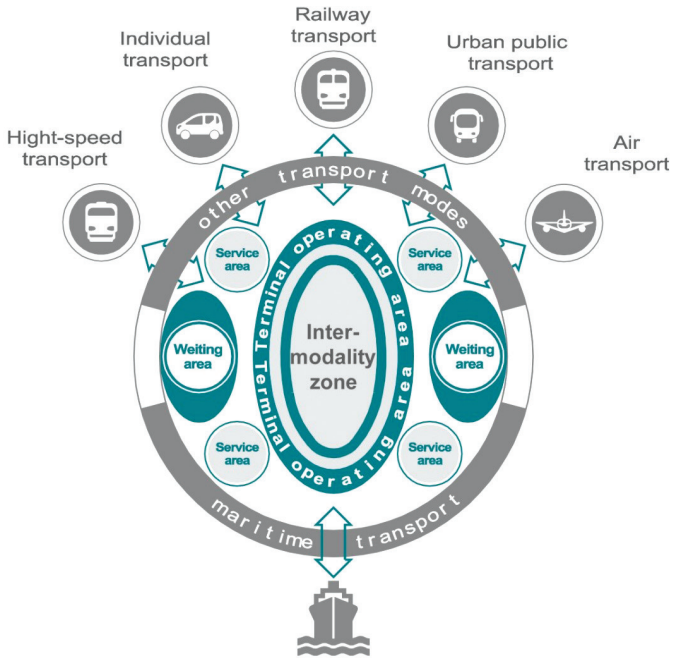
Ill. 2. In this form the complex existed before the start of its reconstruction in 1992 by the Italian company “Tegola Kanadese”

Ill. 3. Before the construction of the hotel (1990’s)


Ill. 4. View of the terminal in 2001–2015

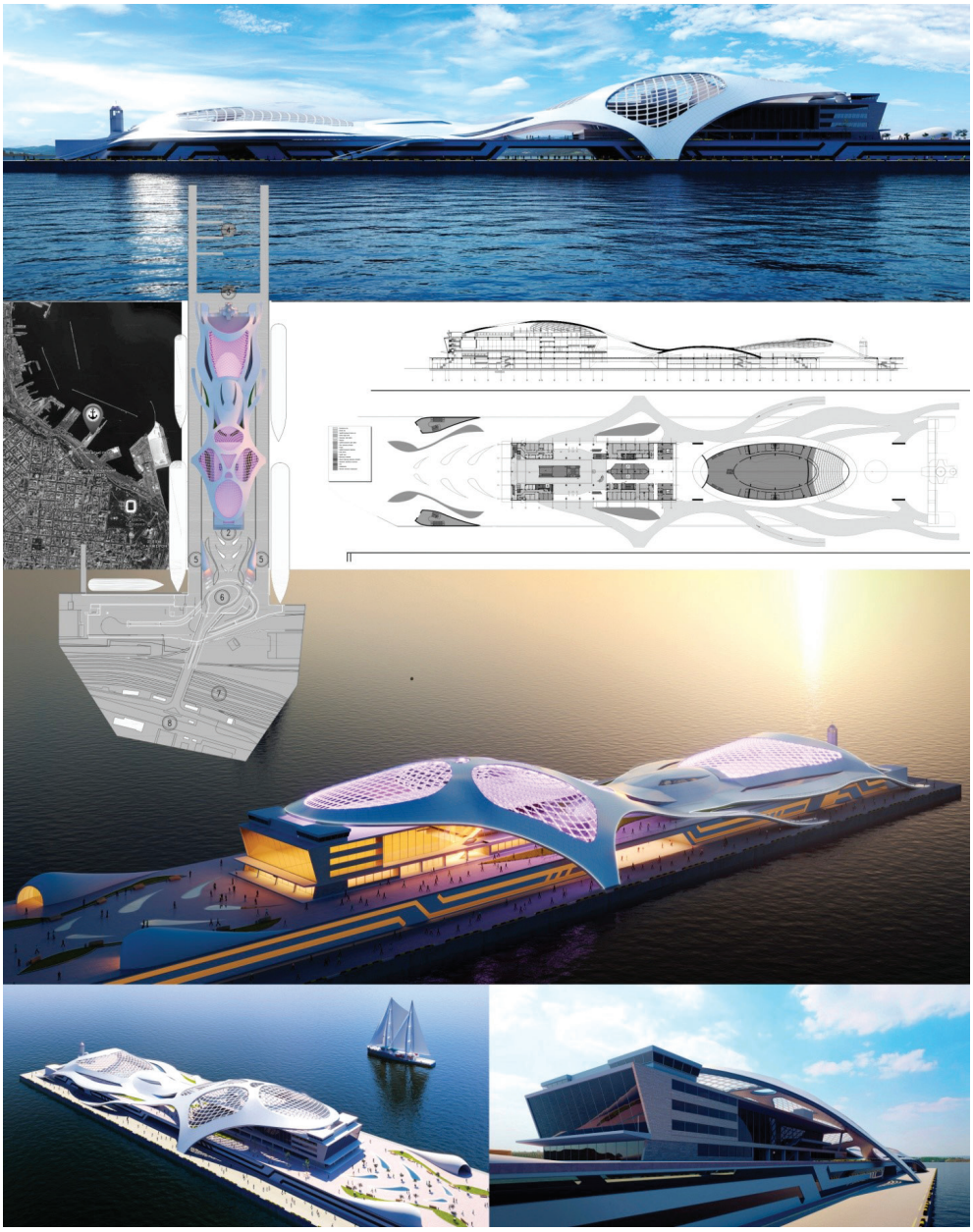
Ill. 5. View of the terminal in 2016–2018

Ill. 6. Project of new reconstruction (2016)



Ill. 7. Basic functional model of the maritime passenger terminal

Ill. 8. Actuall view (2019)



Ill. 9. Sketch project of reconstruction of the maritime passenger terminal in Odessa

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[1] White Paper: *European transport policy for 2010: time to decide,* http://tur.org.ua/sites/default/files/white_book_transport_2050_ukr_0.pdf (access: 13.05.2019).

[2] D.V. Zharkevich, *Architectural and planning organization of passenger terminals at the intersection of various types of transport (for the conditions of the Republic of Belarus)*, Author's abstract, Minsk 2014, p. 6.

[3] *Ibidem*, p. 8.

[4] Which is located on an artificial island in the middle of Osaka Bay off the Honshu shore, 38 km southwest of Ōsaka Station, located within three municipalities in Osaka Prefecture; https://www.jal.co.jp/en/jalcargo/office/inter/kix.html (access: 13.05.2019).

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DATA AKCEPTACJI OSTATECZNEJ WERSJI DO OPUBLIKOWANIA: 13.05.2019.