

INTERNATIONAL AIRPORT ON ARTIFICIAL ISLAND

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Abstract. The necessity and possibility of creating large airports on artificial islands both near the coast and in the open sea are considered.

Key words: Territorial sea, high-speed transport, airports, tunnel, intelligent technology, reasonable artificial island.

The number of people using air travel to communicate with Israel is constantly growing. Ben-Gurion main international airport is already overloaded. According to forecasts, in 2018 its passenger traffic will be more than 24 million people and, according to experts, in 12 years will reach 30 million passengers, having increased by more than 1.5 times [1]. The government intends to modernize the airport. Ben-Gurion, allocating for this purpose an amount close to 1.4 billion dollars. But the possibilities for expanding this international airport are limited. In 2013, constructing of the Ramon International Airport began alongside Eilat. It will serve as a spare international airport for the main Israeli airport Ben Gurion. It is assumed that the capacity of the airport will be about 2 million passengers at year. The construction of the Tel Aviv-Eilat high-speed railway is also envisaged. But even the commissioning of the airport "Ramon" will not solve the growing problem of overloading the international airports of Israel. At the same time, the constructing of new major airports is limited by land resources.

In addition, it should be noted that the work of a major airport creates serious problems for the surrounding population. For example, in China, the mightiness of the existing airport in Beijing was not enough and it was decided to build at distance 68 km from Beijing, Daxing Airport (Daxing), which will have 7 runways and serve 100 million people per year [2]. The airport will occupy an area of 47 square kilometers. Herewith, during its constructing, 20 villages will be evacuated, and the noise from the work of this airport will interfere with another 472 villages. At a high density of the population of Israel, such problems are inevitable for existing airports, and for planned airports.

Particularly necessary to emphasize the impact of noise on the health of people living near airports. So studies conducted by doctors in the United States showed that chronic exposure to noise from airports and heavy traffic on the roads adversely affects the nervous system, and regardless of other risk factors, more than three times increases the risk of heart attacks and strokes, as well as other cardiovascular diseases [3].

All the shortcomings of proximity to the airport understands the population of Israel and actively protests against the creation of new airports in a densely populated part of the country.

Considering all the inconveniences associated with the construction of new airports and the growing cost of land that they will occupy, a country like Japan, which has a high population density, began to create new airports on artificial islands.

The first airport not on land was Kansai International Airport, near Osaka, built in 1994, during almost three years [4]. The airport was 4 km long and 1.25 km wide. The airport is connected with the land by a two-level bridge 5 km long. With 1 runway, its capacity is 25 million passengers per year. One of the advantages of this airport is that the planes take off and land above the sea, the sea reduces outgoing noise and the airport can work around the clock without inconvenience to people.

After that, the airports of the Nagoya Centurion, Kobe, Kitakyushu and Nagasaki were built on artificial islands in Japan, and else new construction is planned [5]. Besides to Japan, international airports on artificial islands there are also in other countries.

Interestingly, the project of the Chinese Daxing Airport is part of a plan to unite Beijing and the large city of Tianjin into the world's largest metropolis with a population of 130 million people. And this airport will have to serve both cities. Tianjin is located near the sea and is 96 km from Beijing. In China, the high-speed transport network is actively developing. And it is quite likely that an airport with 7 runways on artificial island in the area of the Tianjin port could become a good alternative to the ground-based Daxing airport for the entire metropolis. This would significantly improve the situation on the mainland and facilitate the work of the airport.

Israel with an even higher population density than in Japan should obviously take into account this country's experience in building its new airports and make maximum use for this purpose of its most important national resource such as a territorial sea.

The creation in the coastal zone of an artificial island or several islands in different places of the coast for international airports would solve many problems aggravated over time with the existing Ben Gurion airport.

As a first option for the construction of the airport, it is possible to consider the possibility of placing it within the framework of the construction of a nationwide high-speed highway on the sea shelf [6]. In this embodiment, on an artificial base in the form of a peninsula, it is proposed to place runways up to 4 km long (in various configurations and in the required quantity). All ground services, including the air terminal complex, are located on the mainland. The section of the expressway crossing the runway must pass through a tunnel crossing, which must be connected a diverting tunnel to the airport hub and the existing transport infrastructure of the mainland. The least costly construction of an artificial basis in the shallowest part of the shelf at direction the lines of the glide paths above the sea, are the advantages of this option. The territory for this construction must be provided between Hadera and Haifa.

The second option could be considered, proposed in [6] the option of placing runway on an artificial island off the coast, where all the service services for receiving and processing passengers are located on the coast, connecting them with a bridge to the island. When placing such an airport, it will be necessary take into account the flight routes of the aircrafts served by Ben-Gurion Airport and its accessibility. Possible area for him - in the north of Caesarea.

The choice of the design of an artificial island should be made on the basis of many factors, and in the first place such as safety, environmental friendliness, convenience for the surrounding residents and economical. Based on the experience of creating airports on artificial islands in Japan, the time to build an airport on an artificial island should be no more than 3 years, and the construction cost for the variant with a throughput of 25 million passengers per year should not exceed \$ 10 billion. However, strangely it sounds, the head of the State Economic Council under the Prime Minister's office, Professor Avi Simhon, who heads the working group on the development of a project for the construction of artificial islands off the coast of Israel [7], name the construction time of such an airport in the range from 10 to 15 years [8]. Obviously, the considerable experience available in the world in creating such constructions has not been studied enough.

In the future, as a third option, it would apparently be advisable to consider the possibility of creating a large artificial island, remote from the coast at a distance of 5-7 km, and maybe even a distance of 22.2 km allowed for the territorial sea. On such an island could be located a large international airport, a seaport, as well all enterprises providing for its vital activity, such as energy

and water supply systems, sewage treatment plants, security systems. Its operation should be as autonomous, as possible using modern intellectual technologies, which will make it a reasonable artificial island (RAI). For energy supply, RAI can be used the conversion local systems for wind, solar, sea heat and wave energy. Drinking water will be produced using a desalination plant and water enrichment system with vital supplements. Part of the water will be used for technological needs. All waste products of the RAI will pass through the treatment plant, thus ensuring that all environmental requirements are met. On the one hand, all these devices, as well as the service systems of the inhabitants of the island, will be decentralized, and, on the other hand, controlled and, if necessary, controlled by a single intelligent RAI system.

Transport communication with RAI can be carried out by means of high-speed transport through the tunnel laid under the seabed.

In the presence of the seaport and the airport, which have customs services, such RAI can be simply converted into a free economic zone.

It should be noted that at the creation of artificial islands far from the coast, many objections of ecologists and other concerned specialists, which arise when planning facilities near the coast, are naturally lifted.

For many reasons, it is unlikely that such an artificial island will have to be made bulk. There are already some developments in the world to create floating artificial islands to accommodate major airports. One of the first was the project of a floating airport for Tokyo Bay, launched in 1995, Mega-Float Japanese Technology Research Association [9]. The project provided for an airport with a runway of 4 km.

The mock-up tests showed that the project satisfies all the functional criteria developed for the evaluation of its performance in marine operating condition. Test take-offs and landings conducted on a model of a floating airport which reduced to 1000 meters, in Tokyo Bay showed that pilots rated runway as no different from conventional airports and the airport can function normally.

As a result, valuable information and experience was accumulated, but however, for a number of reasons, including due to economic considerations, the project was terminated in 1998.

The experience gained, the new technological capabilities, and most importantly the growing demand for the exploration of maritime space, are drawing increasing attention to the creation of airports on floating islands and encouraging the development of new projects [10]. When designing such a large artificial island, it will be necessary to use all modern technological developments and in many respects what was used in the creation of oil and gas producing offshore platforms.

With the use of modern technologies for the manufacture of large structures and intelligent systems of control, stabilization and control, it will be possible to create large sea platforms that are resistant to sea waves and tsunamis, ensuring reliable and safe operation of large airports on artificial islands.

The figure shows a sketch of a floating island with an airport, remote from the coast beyond a line of the horizon. The transport communication with it is carried out by means of the tunnel laid under the seabed.

Due to the lack of a bulk foundation, as well as the possible vertical movement of a floating island, vehicle to it can be delivered out by means of the elevator, the shaft of which connects to the tunnel.

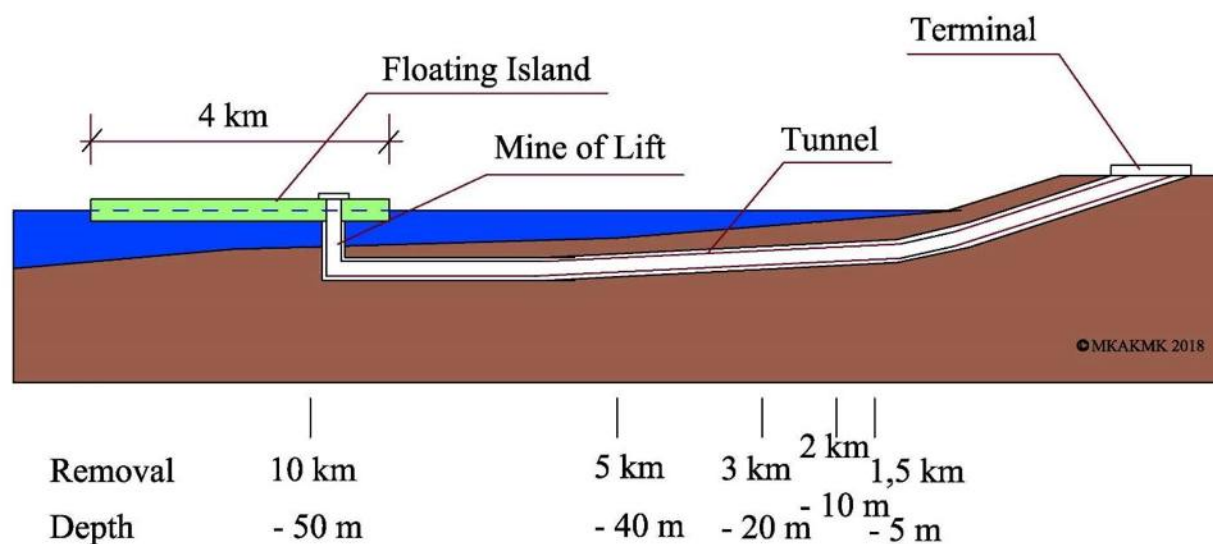


Fig. Sketch of floating island with airport.

As we can see, Israel has ample opportunities to transference its ground airports to artificial islands in the sea.

Relocation the existing international airport Ben-Gurion will solve many problems. And most importantly, it will free people from the inconvenience of the neighborhood with the airport, free up a lot of land for economical needs and increase the security of the airport. And thus, it will provide an opportunity to escape from the multifactorial problems of the existing international airport. Such relocation of airport would pay off many times over.

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