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Designing a museum with an ecological approach in a temperate and humid climate (a case study of Namakabrud in Mazandaran)

Abstract

Mazandaran province has been one of the main victims of neglecting the natural environment. The destruction of 55% of the forests in the north of the country in the last 30 years and the construction of buildings as a barrier against the environment not only caused the destruction of forests and the extinction of various plant and animal species but also caused the energy crisis and the increase of the heat island. The present study is one of the ways to protect the ecosystem and reduce the damage caused by the design of the artificial environment in the natural environment through the cultural and scientific promotion of the people and the construction of ecological buildings by examining different methods. In this regard, a site located at a 12-km distance from west of Chalus, which covers part of the region's land with an area of approximately 650 hectares, and the northern limit of this land is the Caspian Sea, and its southern limit is the Madoben heights (from the heights of the Alborz mountain range) was selected and studied. Also, in the south of these lands, the slopes of Madoben Mountain are located in the form of dense forests with extraordinary visual attractions, which welcomes many nature enthusiasts annually. The study aims to design the ecological museum based on the potential of the site and to create an ecological relationship between the environment and an exhibition and cultural space based on the microclimate of Chalus city to promote the culture of respect for the environment and to preserve the ecological identity and to maintain the balance cycle of nature. The design of the ecological museum should include more than a single building, include its surrounding environment and be a sustainable form of the urban environment and ecosystems. This project approaches the subject through analysis, reflective analysis, and applied research methods that are quantitative and qualitative in two directions will be used. As a result of designing the ecological museum, I have been able to create a green balance between the environment and the building, respond to the energy crisis by using renewable energy, and by creating an educational and research space, I have been able to present a solution for culture and the extinction of plant and animal species.

Keywords: *Museum, Ecologic, Tourist, Renewable energy, Indigenous design.*

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Introduction

Today's civilization is facing terrible danger, and now all people understand this danger for the first time and act as a result of the fear of destruction. Almost a hundred years ago, Wright proposed solutions in the form of architecture and showed how it is possible to live in harmony with nature and the ecosystem, not live in fear (which is a human instinct). He believed that if humanity is exposed to nature and ecosystems and is intertwined with their tangles, it will organize spiritual growth. Man-made design cannot be considered as a separate part from nature and cannot be completely distinguished from each other. In other words, every design requires cultural, identity, and ecological interaction with the context, and a purely economic thought will not lead to anything other than the destruction of the urban and ecological identity of the region and the fossil fuel crisis.

Thus, it is logical to find a basic and fast orientation towards ecological design to make the artificial environment of our thoughts. In an ecological design, the architect must look at nature as a dynamic system and consider the artificial environment to be dependent on it. This relationship is called continuity, which is the basis of ecological design to understand the relationship between the living and non-living parts of nature. Also, the artificial environment is a variable dependent on ecologic, climate, nature, human, human needs, and desires. This is the path ignored in today's design process. In an ecological design, it is necessary to evaluate these indicators: if they build, where do they build, what do they build and how do they build? In practice, ecological design is considered a human intervention in nature. The aim of ecological design is not to preserve nature from human impacts, but rather to attribute human interventions in the ecosystem to nature in a way that causes minimal damage. This means recognizing the limitations of the ecosystem per se.

Only through this way we can organize and make our interventions harmless by designing buildings that are as useful as possible for the ecosystems and with predicted changes suitable to the environment. Also, this design method is a solution to reduce energy consumption and energy natural and preserve the ecological identity and appearance of the city. The issue of the green design was proposed following two major developments at the international level, one was the oil crisis of 1973 and the other was the protests of the green group and environmentalists on land pollution and the destruction of the environment due to industrial development

and the accumulation of toxic waste from factories, as well as the damage to the ozone layer.

Nowadays, ecological design is seriously considered by the countries of the world and international organizations, and people of the society are looking to replace the green ways of living in their environment. Green thinking in professional designers has caused them to gradually turn to green architecture, and some results have been obtained in this area. With this view, great architects such as Wright showed respect for nature in the design of their buildings. As an example in this regard, we can refer to his waterfall house. Norman Foster designed the American Air Museum in Cambridgeshire in such a way that he buried the structure in the ground to integrate them with the green space and took advantage of the thermal capacity of the soil to save energy, which is completely following respect for the environment and ecosystems and use of planned natural energy.

Nowadays, in the modern world, they have concluded that ecological design offers multipurpose solutions. Problems in nature caused by human intervention and the resulting pressures can be seen in several forms. Depleting, transforming, or adding to the earth's resources or ecosystems (both global and regional), ecological design methods try to minimize the harmful effects of humans (artificial structures) on nature. It is the responsibility of the designer to minimize the unpleasant consequences of building and consider this idea as a priority to remove the destructive and negative impacts of ecosystems and natural resources and establish ecological goals.

According to this view, the areas like Chalus city have become unique areas with a natural landscape due to the interaction between the sea and the coast, the presence of diverse and valuable natural ecosystems, and the location of this coastal strip between the two poles of the sea and the forest, which have a short distance from each other. However, due to population growth, followed by an increase in construction and urban development, regardless of the ecosystems and forest and beach boundaries, and lack of proper planning and management for coastal and forest uses, the ease of intervention in nature due to technological developments, the dominance of economic goals over decision-making, the dominance of individual interests over collective interests, waste production and destruction of natural ecosystems will be a consequence of the environmental and ecological crisis in the future.

Continuous and unlimited town building and the use of land have changed the relationship between man-made environments and nature and have turned it into a reverse state. It means that the human globe transforms from the state of a system taken over by nature and the earth into an inclusive system. Ecosystems are increasingly saturated with man-made systems and have lost their capability to self-regulate and absorb human products. Their other impact is to destroy biodiversity. These processes can have a regional or global direction. The importance of performing this study to create a suitable place for performing studies related to plants and animals has led to an increase in people's awareness and knowledge of nature, since their extinction and the reduction of green space, in addition to disturbing the balance of the ecosystem, it will lead to an increase in heat islands. Also, the use of renewable energies in the construction of the ecological museum, as well as the advantages of its use in architectural spaces, can have a great impact on people's awareness and the development of the use of renewable energies and the training of expert forces in this area.

This study aims to reduce the damage caused by construction on the ecosystem, prevent the extinction of plant and animal species by educating people, and also optimal energy consumption in the building. Thus, the results of this study can be provided for organizations related to the environment and Mazandaran Province Cultural Heritage Organization, Mazandaran Province Engineering System Organization, Mazandaran Province Housing and Urban Development Foundation, Chalus City Municipality, and Namakabrud Municipality.

Sustainable Architecture

Sustainable design is a type of intervention in the environment that tries to invent solutions to achieve a balance with environmental, social, and economic goals in a holistic and integrated view that can provide a superior quality of life for the life of the current generation and a suitable legacy for future generations. Since the main concern of sustainability is paying attention to environmental conditions, environmentally sustainable design is a kind of approach to the design product that maximizes the benefit of the internal characteristics of the substrate and environmental conditions, while minimizing the adverse conditions resulting from this construction. From the stage of design and establishment, the buildings should respond well to the conditions and situation, while minimizing the confrontation with nature. In other words, the issue of sustainable architecture is comprehensive. It does not lead to an architectural style like the previous tendencies. Although its main concern is related to the issue of the environment, it uses all the previous tendencies that pay attention to the issue of reducing the use of materials and energy. Tendencies such as technological architecture, green architecture, intelligent architecture, as well as environmental design, behavior-oriented architecture, economy-oriented architecture, etc., are distinguished from previous architectures that followed the creation of pure form. It can be stated that sustainable design is a type of architecture that

uses the maximum environmental talents for the comfort of consumers and uses smart tools and solutions in this way.

Ecological architecture

Ecological architecture is mainly concerned with how ecological characteristics affect buildings, their inhabitants, and the environment. This term is generally used as a framework to describe the multi-stage design of ecological buildings and their balance and harmony with nature. The importance of building designs based on ecological characteristics is clear since such activities not only affect the environment at the moment, but their effects will affect the next generations and cause the survival and sustainability of the environment for them. At present, we should eliminate the opposite thoughts as much as possible with our predictions although our efforts to design green buildings cannot completely cover the ecological goals (due to the lack of technology and other factors). The primary condition is the sustainability of the ecosystem and maintaining its integrity and integrity since in this case, they can compensate for the pressures that have been put on it by humans and remain biologically dynamic and productive. To be more precise, ecological design should be considered a beneficial and productive partnership with nature, which in addition to ecological design should be an activity to restore and renew natural systems. Ecological design usually provides multifunctional solutions. Problems caused in nature due to human intervention and the resulting pressures can be considered in several ways. Depleting, transforming, or adding to the earth's resources or ecosystems (both global and regional), ecological design methods try to minimize the harmful effects of humans (artificial structures) on nature.

Nature as a guide for ecological design

Humans were very close to nature at the beginning of their appearance. Their direct and compatible relationship led to harmony or at least balanced harmony. Time passed and their number and knowledge increased. Their attitude towards their environment changed. They learned to protect themselves from the weather and ruthless enemies. With a sense of superiority and arrogant and blind power, they unintentionally became enemies of nature. As people moved further and further away from their origin, they made their living space more alien from their original life. They turned away from nature. Designers use the principles and rules governing nature in their designs and take help from nature as a teacher in what methods nature uses to produce products. For example, in the forest ecosystem, food is circulating in a complex set of plants and animals and takes energy from sunlight, and does not produce any waste.

Nature is a pleasant source that can be touched, felt, and heard. Nature fulfills both the functional purpose (purifying the air) and the spiritual purpose (exalting and purifying the soul and reducing stress). Creating nature in the inner porch of buildings is associated with a similar increase in efficiency in the works performed in the inner nature of the building. In the Victorian house, nature is a commodity on a commercial scale and almost a luxury like the building. It makes us think that our buildings are connected to us in another way, as a kind of life essence that affects our lives as living organisms. Nature gives them the consciousness of buildings and then, in Carl Jung's theory conditions, they turn from inanimate things into living things.

Museum

All the works leading to the establishment and operation of a museum are generally called museology. The knowledge of museology in practice included 2 parts that are complementary to each other. One is to collect and maintain the collection and the other is to exploit it. The history of museology in its modern sense dates back two centuries ago. In the 18th century in Europe, collectors paid more attention to the scientific study of its science and application. Collecting was often done with a very specific intention and meaning. However, without a doubt, Gasper F. Nickel’s action is the turning point in studies and the classification of collections. He was a wealthy merchant living in Hamburg. He assigned his research advisors to collect the best and most efficient objects of the natural, scientific and artistic life of the time and classified them in the best ways, and take action to keep them with scientific methods.

In its simplest form, a museum is a building that includes a collection of natural works or human remains to visit and study. These works may come from the depths of the earth and the sea, or it may be a piece of an ancient building, or the fossils of extinct animals of the past millennia, or the eggs of rare birds, and a man-made object like a piece of nomadic pottery from three thousand years ago. In addition to keeping objects, the museum also identifies their identity, and this is the beginning of recognizing and knowing an object and communicating with it. This connection causes the thoughts of the visitor to travel far away from his familiar environment.

In the third stage, the museum exposes the collection in such a way that the visitor is guided to scientific use in addition to entertainment. The way of presenting works and objects should be so thoughtful that the visitor feels happy, thinks about it, and become interested in visiting it again. One of the most important tasks of the museum is to display the story of the past man in front of the eyes of contemporary man. It shows how he acquired his knowledge about the world in which he lived, how he built his family life, and how he built his art, industries, and culture. Several years passed until the man reached a stage where he collected objects to show his social credibility.

Collecting and visiting these collections created happiness and entertainment for rich people. In the final stages, the collection reflected the taste, elegance, and cultural interests. These works were passed from person to person, inherited, and entrusted to endowments. These works needed a suitable place for storage, which was often not available for the owners of the collection. Also, their spirit of culture causes them to find a way for others to participate in using the collections, and this was the beginning of assigning them to public institutions. Thus, it can be stated that the creation of an institution called the museum in its initial stages was a response to the establishment of donated collections.

Ecotourism

Ecotourism is a relatively new tendency in the tourism industry. The natural environment, traditional livelihoods and ways of life, and beautiful landscapes of nature are the main goals and tourist attractions of this type of tourism. Protecting the environment and preserving traditional culture is a priority to sustain and develop this industry. Ecotourists, who travel to natural and pristine areas of the earth with their motivations, will gain beneficial experiences. They are acquainted with the cultural-environmental aspects, and the nature of each region and country, and join the nature lovers and preservers. In the tourism area, natural attractions and effects have more value, and from these aspects, they form one of the most important forms of ecotourism. The main activity of tourism is based on nature and improves the quality of life of local people. Ecotourism causes minimum damage to the nature and culture of the region. The importance of ecotourism development becomes apparent when we know that the average trip of 50% of the world's ecotourists is between 8 and 14 days. Based on statistics, each ecotourist brings foreign currency of about 1000 to 1500 dollars on average. This statistic along with the high volume of Iran's ecotourism capabilities suggests how much Iran can earn currency. Ecotourism is an environmentally responsible arrangement to enjoy relatively pristine natural areas (and any cultural characteristics in the area from the past and present) and promotes the environment. During this trip, tourists cause minimum negative impacts on natural resources and local people enjoy the benefits of socio-economic activities.

Ecotourism is a type of travel to fragile, pristine, and often protected areas, which tries to leave little and almost small impacts. Ecotourism enhances the knowledge of visitors, provides resources for conservation, provides direct benefits of economic development and political empowerment to the local community, and respects various cultures and human rights. Real ecotourism requires a proactive approach to reduce the negative impacts of nature tourism (ibid). Sustainable tourism and tourism are various terms used for nature tourism or ecotourism. Ecotourism is a type of tourism that is based on traveling to relatively undamaged natural areas.

Sustainable Tourism

The main goal of the extension of sustainable tourism meaning is to provide logical methods for the use of natural and human resources and to prevent the non-scientific use of these resources. The sustainable development of tourism has three aspects: a) protecting the environment, b) preserving resources and cultural heritage, and c) movement and respect for communities. Thus, sustainable tourism should be implemented with a specific and well-developed policy to ensure a promising movement in the comprehensive development of geographical spaces. The principles of sustainable tourism can be described as follows. Preservation and use of resources (natural, social, and cultural) are crucial and mean long-term business and lack of excessive consumption and waste. This prevents reconstruction costs and long-term damages and helps the quality of tourism. Preservation and promotion of natural, social, and cultural diversity are of particular importance for the long-term sustainability of tourism and make tourism flexible. The expansion and development of tourism in a local and national strategic planning framework that considers the effects of the environment increases the long-term sustainability of tourism. Tourism should support economic systems by covering local economic activities and considering environmental values and costs.

The participation of local communities in the tourism sector is not only for their benefit and the environment but also improves the type of tourism experience. Consultation with beneficiaries and public people: Consultation between officials, managers, and investors of the tourism industry and local organizations and institutions is important. This makes people cooperate and put aside their difference of interests. The training of the crew ensures compliance with the standards. Also, hiring a local crew improves the quality of tourism. Since marketing provides complete information to tourists, it not only increases respect for the cultural, social, and natural environment of sightseeing areas but also increases customer satisfaction.

The goals of sustainable tourism as a model for regional development include the following items:

Improving the quality of life of the host community, providing quality trade for the visitors, and preserving the environment that both the host community and the visitors depend on

These goals allow the host community to reach an acceptable balance while earning income from tourism, considering issues such as the need to preserve resources, minimize damage to the environment, reduce pollution, and achieve social balance. According to these goals, tourism plans at the

logical level tend towards sustainability in a way that considers the following items:

• Balance between the volume and type of tourism activity.
• Sensitivities of the region.
• Resource capacity for development.

Otherwise, tourism is considered not only a harmful activity but economically indefensible and failed activity (ibid)

Site Analysis

Namakabrud is a tourist town and villa in Mazandaran province. The new town of Namakabrud, which is located twelve kilometers west of Chalus, covers a part of the area with an area of approximately 650 hectares. The northern limit of these lands is the Caspian Sea, and the southern limit is the Madoben heights (from the heights of the Alborz mountain range). The existence of Banafsheh and Shamshad forest parks in the northern part of this complex with an area of approximately 200 hectares has created unique landscapes in this part of the land. In addition, in the south of these lands, the slope of Madoben Mountain is located in the form of a dense forest with extraordinary visual attractions, while the desired site for the design of the museum is located on the slope of Madoben Mountain.

The site is located within the Namakabrud texture. As you can see in the photos, there are private villas on the north side of the site, which, due to their location on the mountain slope, did not destroy the view of the site on the north side, and on the south side, it has been involved with the Alborz mountain range and has a natural topography with varying slopes and sparse vegetation. When the gondola lift lines move from the top of the site, this pristine view can be seen. Vegetation is located on the western and eastern sides of the site, which is adjacent to the western side of the Abshar Restaurant and the eastern side of the site are the gondola lift lines and the sledding track.

These recreational facilities on both sides of the site indicate the gathering of tourists around it, which will be a turning point for tourists to visit the ecological museum (1). In this area, due to the distance from the Caspian Sea and the reduction in humidity, the type of trees and the forest landscape change. The forests of Mazandaran are widely used, including in the industries of papermaking, woodworking, fuel and charcoal, and so on.

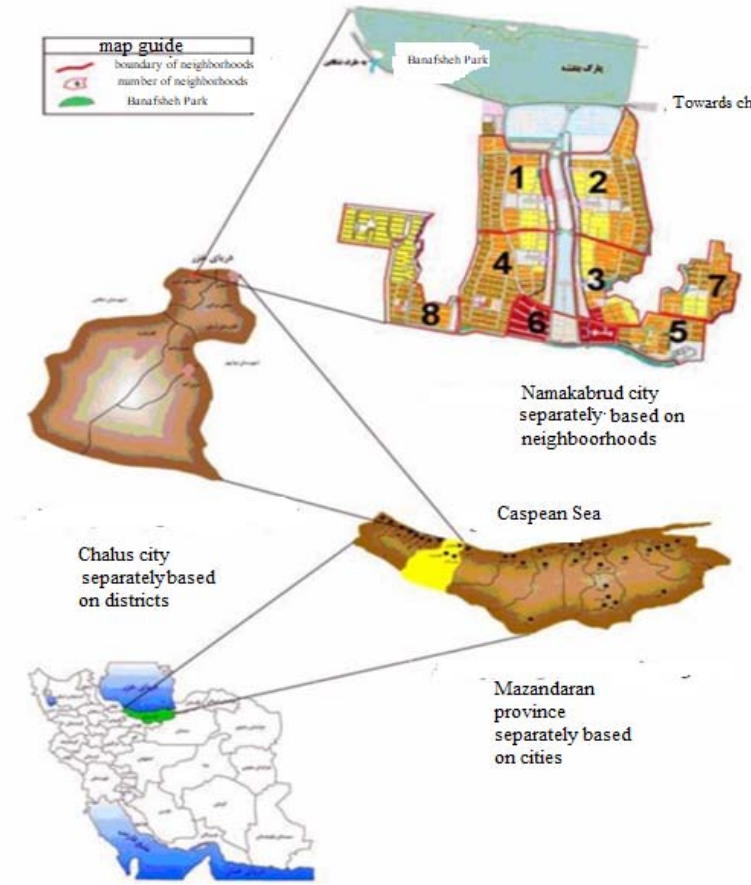

Figure 1: Geographical locations of Mazandaran province on the map of Iran and Namakabrud town

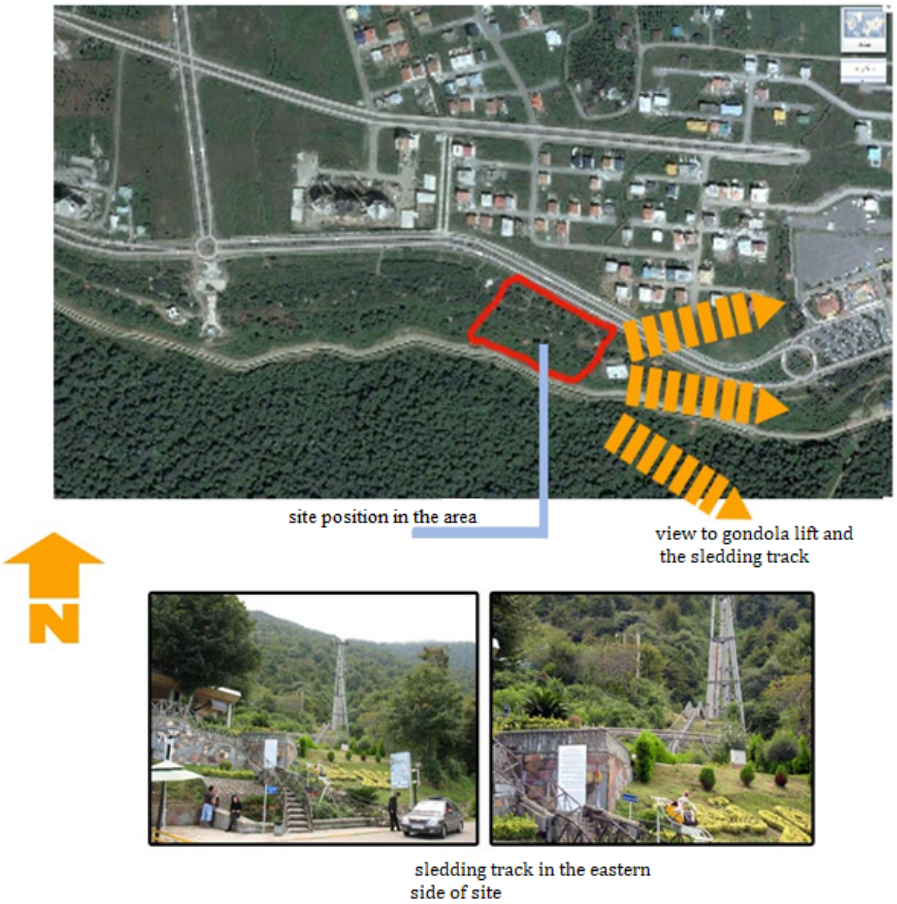

Figure 2: The location of the Namakabrud site and the view of the gondola lift and the sledding track in the vicinity of the eastern side of the site.

The access route to the Namakabrud area is on the movement axis of Chalus to Abbas Abad. The access lines to the site are in the north-south direction from the entrance of Namakabrud town to Abshar Restaurant, which is perpendicular to the main axis lines, and finally, to access the site, you have to move in the direction perpendicular to this axis, which is from west to east and it is located near the northern side of the site. Due to the location of the site in the vicinity of the Alborz mountain range, it has a natural slope with tolerance, which has placed the site in a wonderful position in terms of the view of the surrounding environment with a beautiful view of the town.

Based on the EIA method and according to the figures obtained in the checkered grids inside the site, it can be seen that a specific part or surface cannot be considered for the design and placement of the building inside the site, and the surface designed and occupied by the building should be decentralized inside the site (Figure 3).

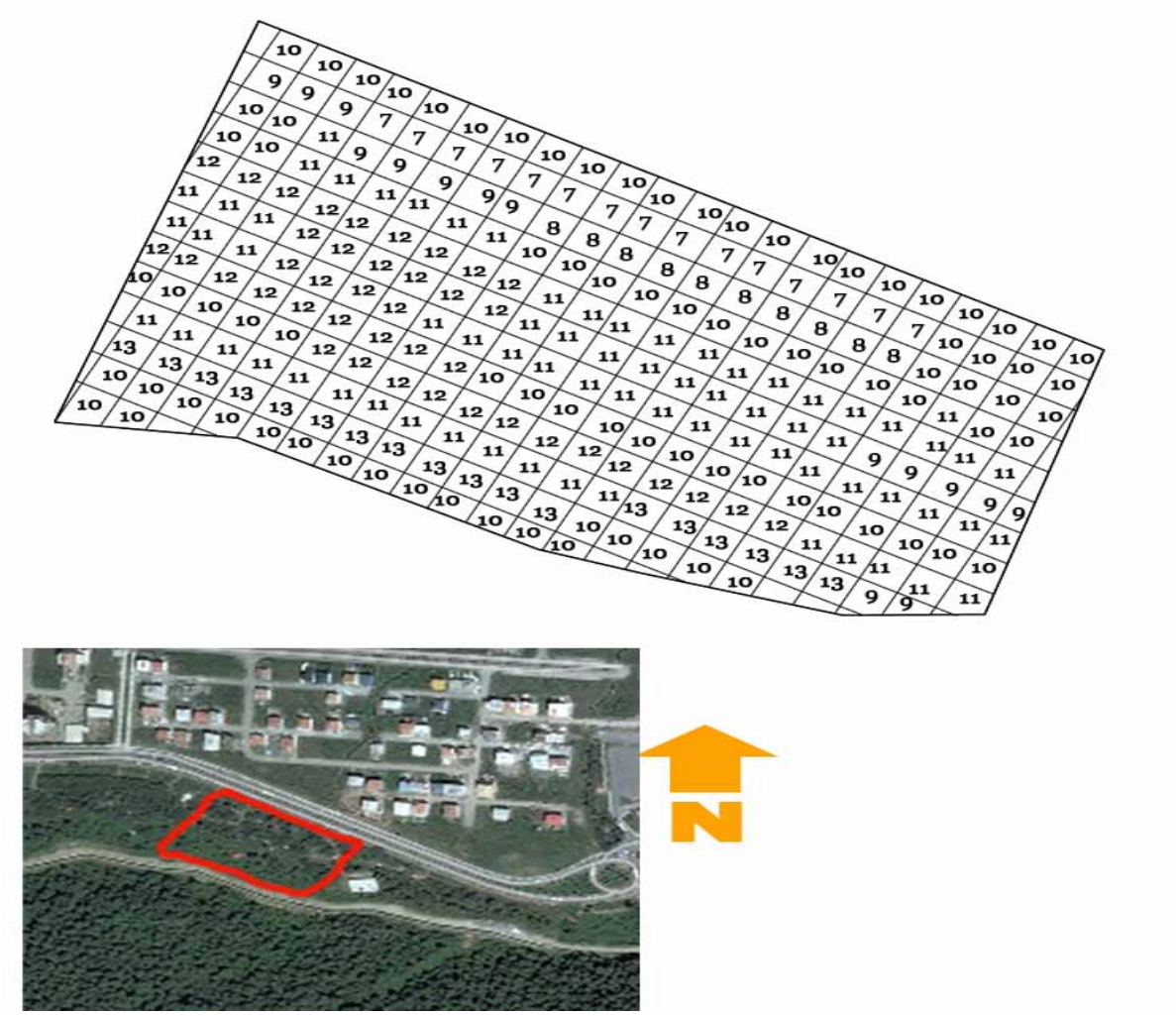

Figure 3: Summary of the EIA method

Results

Zoos and aquariums

The main entrance of the zoo includes goods glassy display shelves, payment desks, and information kiosks, toilets, large parking spaces for cars, stations for public transportation. It also usually includes spaces for the administrative part, all departments serving the public, lecture rooms, also a luxurious restaurant overlooking the zoo area (all with separate entrances from the outside for evening work), other restaurants, self-service cafeterias, etc., toilets, and picnic areas. Operational departments should have separate entrances and be safe from public view. These places require large outdoor areas to store food, waste disposal materials, fodder, straw, sand, gravel, soil, building materials, etc. Facilities for washing, disinfecting, and changing clothes, cafeteria, quiet training rooms (night guard), provision for central and local preparation of food, water, waste disposal, rooms for car washing service, transport units, skid steer loaders, portable cages, and gardening equipment should be considered inside the buildings. A workshop for carpentry and painting is also required, including the necessary warehouse storage space. Other facilities include a veterinary hospital, animal quarantines, research laboratories, breeding areas, and carcass storage (cold storage) and disposal. Heating, cooling, and ventilation systems should be designed for everyone .The bird cage should not be exposed to direct sunlight or in a very dark place. Mild sunlight is beneficial for their health. Also, in cold places, a part of the cage should be covered and even its walls can be covered with plastic. In the bird garden complex, where the entire area is covered by a net with a suitable height, the place of construction of the bird garden is very important because the whole complex is like a large cage. The direction of the wind, sunlight, slope, and height of the place should be considered in this regard. The available facilities in the bird garden should meet the capacity and needs of the collection and can provide the best conditions for visitors and birds. In general, the buildings that are proposed for such collections are:

1- Administrative building 2- Quarantine 3- Clinic (should be equipped to keep sick birds) 4- A storage place for fertile eggs and chickens 5- Equipment, food, and medicine warehouse 6- Worker accommodation 7- Cold room and hot

house 8- Health service 9 - Welfare services (buffet and restaurant) 10- cages (if the birds are kept in cages). If the bird garden is built under cover, it is crucial to pay attention to the type, material, shape, height, strength, and dimensions of the roof, columns, and side fences. It should be noted that the roof and columns should be designed by an experienced engineer or architect who has a valid engineering system because this work requires accurate engineering information. The roof of the bird garden can be conical (tent), cylindrical or circular (dome). The best height that can be experimentally considered for the construction of a bird garden with the existing equipment and facilities is between 15 and 20 meters. The surrounding wall is recommended to be a combination of a picket fence and fence with small fountains (to prevent the passage of mice and small birds) and the base of the wall should be considered to be large enough to prevent animals such as foxes from burrowing.

Museum and gallery spaces

As much as possible, each group of pictures in an art gallery should have a separate room and each picture should have its wall, especially in museums, where there should be an interesting and logical sequence in this regard. This method provides more wall space than the floor area of large rooms. The normal angle of human vision starts from 27 degrees above eye level. For the standing observer, this means that well-lit pictures should be hung on the wall at a distance of 10 meters and less than 4.90 meters above eye level, or about 70 cm below eye level. The best situation to install smaller pictures is the emphasis point (horizon level in the image) on the eye level.

Therefore, it is necessary to allocate a surface of 3-5 m^2 for each picture, allocate 6-10 m^2 of floor area for each sculpture, and allocate 1 m^2 of cabinet space for every 400 coins. The necessary calculations for the lighting of museums and art galleries are completely theoretical and the quality of the light is determining factor. The experiences in America can be useful. Recently, the use of artificial light instead of the ever-changing daylight (even if it is northern light) has increased. Based on the observations in Boston, the optimal viewing space on the wall is between 30 and 60 degrees up from a point in the middle of the floor of the room. It means a fixed height of 2.13 m for pictures and a visible range of 3.00-3.65 m for sculptures. In art galleries, there is generally no continuous chronological route.

Table 1: Design area

Space	area
The entire zone of the ecological museum site	46763.27
Built zone	15293.51

Table 2: Botanical garden area

Space	area	Space	area
Plants breeding site	300.71	1	300.71
Gardening equipment warehouse	20	1	20
Plant selling stall	15	2	30
Seed planting site	100	1	100
Laboratory	100	1	100
W.C	10	2	20
Garden temperature controller installation room	30	1	30
The total infrastructure of the botanical garden	671.07	2	1342.15

Table 3: Area of Natural History Museum

Space	area	Space	area
Wildlife exhibition hall	2286.52	1	2286.52

Cleaning supplies warehouse	20	1	20
Warehouse Equipment	30	1	30
Temperature and humidity control room	50	1	50
Museum catalog booth	20	2	40
Control room	30	1	30
W.C	15	2	30
The total infrastructure of the Natural History Museum	2486.52	1	2486.52

Table 4: Bird garden area

Space	area	Space	area	Descriptions
Bird sitting site	2697.36	1	2697.3	Includes water and waterside birds that are dependent on the reservoir and terrestrial animals and butterflies are identified.
habitat	500	1	500	Includes trees, shrubs, and bushes.
Bird training site	200	1	200	Special parts for training birds.
Rooms for recovery	80	1	80	To adapt to the climate and internal and external observations.
Bird egg storage site	50	1	50	A site to store fertile eggs and chickens.
Quarantine rooms	50	2	100	Equipped with air cooling and ventilation system with 12-15 times of air replacement per hour (separate for quarantine rooms).
Refrigerated rooms	60	1	60	For animal carcasses, it is the dissection and burial room.
clinic	120	1	120	It should be equipped to keep sick birds.
Laboratory	60	1	60	
warehouse	50	1	50	Includes food storage and its preparation, medicine, and equipment.
Cleaning room	50	1	50	Steam is often used in cleaning equipment
Garbage disposal site	50	1	50	Disposal of bird excreta and carcasses
purification room	40	1	40	There are water purification facilities and filters.
Separate access routes	250	1	250	It included routes with a width of 3-4 meters for portable cages, which were separated from the routes of visitors.
Workers' residence site	80	1	80	Staff room with disinfection equipment.

Installation room	50	1	50	Cold room and greenhouse to control temperature and humidity.
Bird garden catalog booth	80	1	80	
W.C	30	2	60	W.C for employees should be separate from visitors
The total infrastructure of the bird garden	4577.36	1	4577.3	

Table 5: Aquarium area

Space	Area	Number	Area	Descriptions
river aquarium design	50	1	50	The first floor: a river aquarium because they use rubble and stone rocks on its bottom.
Coral aquarium design	50	1	50	Second floor: Coral aquarium because it is an environment covered with corals and sea shells.
swamp aquarium design	100	1	100	Third floor: swamp aquarium because it is covered with wheat plants
warehouse	40	1	40	Includes food warehouse and its preparation, medicine, and equipment.
Laboratory	80	1	80	They check the water and the health of the fish.
Aquarium catalog booth	60	1	80	It contains the specifications of aquarium fish.
Installation site	67	3	201	The temperature control room is water.
Access routes	340	1	340	
waiting lobby	100	1	100	
ticket sales	20	1	20	
The total infrastructure of the aquarium	1040	1	1040	

Table 6: Taxidermy area

Space	Area	Number	Area
taxidermy hall	120	2	240
Laboratory	80	1	80
Equipment warehouse	60	1	60
W.C	20	2	40
Taxidermy infrastructure	420	1	420

Table 7-administrative area

Space	Area	Number	Area

manager's office	60	1	60
secretary's room	15	1	15
Deputy's room	40	1	40
conference room	120	1	120
Archive room	30	1	30
Secretariat	30	1	30
public relations	30	1	30
Accounting	45	1	45
Staff	28	2	56
Safety room	30	1	30
Prayer room	40	1	40
Pantry	15	1	15
Home phone	25	1	25
W.C	15	2	30
Lobby and access road	470	1	470
Terrace and green space	250	1	250
The total infrastructure of the administrative part	1390	1	1390

Conclusion

The physical plan is a checklist of the required spaces of the ecological museum, which includes natural history museum space, bird garden space, aquarium space, taxidermy space, botanical garden space, research space, science library space, gathering hall, service space, exhibition space, sales booth, administrative space, and open space where the dimensions and sizes of the spaces are calculated. In this project, based on the shape of the building and the rotational movement around specific axes, a structure with a concrete frame and a pre-stressed roof is proposed. In the structure of buildings, the pre-stressing system allows the creation of a freer opening between supports. Also, the thickness of concrete slabs is less, the number of beams is less and thinner, and the possibility of making impressive and spectacular member builders are some of its advantages. A thinner slab means less concrete is used. Also, the overall height of the building is less than the building that does not use a pre-stressing system. Therefore, the pre-stressing system makes the weight of the structure decreased significantly compared to the normal concrete building with the same number of floors. This issue reduces the burden of the foundation and can be its main advantage for seismic areas. Compared to a building with similar conditions, a short building needs few mechanical systems and less exterior facade cost. Thus, economic saving is achieved. Another advantage of the pre-stressing system is that beams and slabs can be used continuously. For example, a single beam can extend continuously from one end of the building to the other end.

The pre-stressing system is also used for parking structures since it gives high flexibility to the designer for the design of the columns, the length of the free opening, and the shape of

the ramp. The parking lots in which the pre-stressing system is used can be both as an independent structure and as one or more floors in a residential or administrative building. In areas with loose clay or soils with low bearing capacity, the use of slabs on the ground or wide foundations with a pre-stressing system eliminates the problems caused by cracks and asymmetric leaks. This method is crucial for building bridges with different geometric conditions such as curved bridges and high bridges. Also, the pre-stressing method makes it possible to build bridges with very large openings without using intermediate bridge supports.

According to information collected in the design of the ecological museum, the standards of living conditions of each of them (aquarium, botanical garden, natural history museum, bird garden) should be observed in the design. Temperature and humidity control are also crucial in all of them. The presence of visitors in these spaces should not endanger their living conditions. Additionally, with the design of the research center, science library, and planetarium (virtual space), visitors will be trained while visiting the museum. This is a big step in line with creating a culture and respecting the ecosystem. By looking at the structure of the building and how it is connected with the surrounding environment, they see that by using solar panels, we produce the energy required for the ecological museum, and by creating a green roof, we connect with the environment and it leads to maintaining the balance of the ecosystem and life cycle.

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Conflict of interest

None.

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Ethics statement

None

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