Ways of Integration of the Landform Architecture Buildings with Landscape

Natalia Novoselchuk, Liudmyla Shevchenko, and Mohammad Arif Kamal

Abstract Presently, in the context of ecological crisis, the modern architecture wends the way of the sustained development conception. There are rethinking of approaches and planning methods, including traditional attitude of architecture toward a landscape, influence of artificial, anthropogenic environment on nature and man. It resulted in becoming of landform architecture as a particular trend at the end of XX century. This article is aimed at exposure and systematization of ways of integration of buildings with landscape on the basis of the landform approach. The evidential analysis, empiric and system analyses were involved to achieve this objective. A scientific novelty consists in the exposure of ways, systematization and generalization of possible types of integration of building with landscape. The research resulted in emphasizing of three types of such integration: above-ground, deepened in relief and underground buildings. Building synergy with landscape is considered on the example of different types of relief: plain, hill, mountain, cavity. Based on analysis the composition ways of a building form synergy with natural surroundings are distinguished. Practical value of this research consists in possibility to use the distinguished ways while planning and building the landform architecture objects.

Keywords Landform architecture · Building · Landscape · Terrain · Integration · Landform approach

1 Introduction

Relation of architecture, nature and human being always was indissoluble. The interactive effect of facilities with terrain begins upon since before Christ at creation of caves, mud huts, burial mounds, at the turn of XX–XXI centuries the interrelation of nature and architecture appears.

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V. Onyshchenko et al. (eds.), *Proceedings of the 3rd International Conference on Building Innovations*, Lecture Notes in Civil Engineering 181,
https://doi.org/10.1007/978-3-030-85043-2_50

It becomes as never actual—basing on the ecological theory the architecture acquires the further development. New tendencies such as organic, "green", nature integrated, bioclimatic, landform architecture and other appear. Natural materials and components are used as "construction materials". They have a number of positive qualities: from the improvement of the sanitary-hygienic condition of municipal environment to the improvement of physical and psychical health of human being.

Subjects such as stability and maintenance of environment by creation of more ecological structures that prevent negative influence are actual in architecture. New methods of planning, NT, requirement for improvement of the environmental attributes, priority of the organic approaches, ecological materials and constructions caused rethinking of traditional attitude of architecture to the terrain and assisted becoming of the landform architecture as a separate direction at the end of XX century. In modern architecture, conception of «building according to the form of relief» is far more than a formal strategy. Today integration of a building with landscape is the modern and perspective approach that changes the traditional architectural form and creates new character of modern architecture.

Presently the architectural objects based on the landform approach are built in the whole world. Different after their form they are based on a general feature—blurring of limits between the natural and artificial. Conception of landform architecture offers the challenge for synergy between nature, individuals and artificial environment. Such conception allows to architects to design building and environment, that evolves with the course of time and complies with natural, climatic changes and needs of users. Landform architecture, as a result of integration of artificial object with natural terrene, conflict-free interaction becomes a part of environment. Landform architecture adopts the laws of morphogenesis of earth and comes forward as the articulated landscape [1].

Works of architectural theorists and practicians are dedicated to the study of land-form architecture. A number of scientific publications, articles, abstracts of thesis have been analyzed during examination of this subject. Examination of the field experience is based on analyses of the implemented projects of the landform architecture and design documents from every corner of the world.

Research of land-form architecture is represented in work by S. Allen and M. McQuade "Landform Building: Architecture's New Terrain" [3], genesis of new formal strategies is determined, the existent projects are shown with illustrations. Shown here are works of modern architects T. Dean, J. Ishigami, T. Ito, T. Kimura, A.P. Kis, M. Maitzan, R. Nishizawa, C. Taylor, D. Perrault, P. Rahm and other.

First empiric and theoretical researches of landform architecture are presented in works of the practician scientists: Sten Allen [3], Kennet Frempton [4], Diana Balmori [5], Michael Manfred [6]. This conception was examined afterwards as possibility to create ecological spaces and new green belts in the volume of building.

Afterwards this trend was considered as possibility to create the ecological spaces and new green zones in cubic content of the building. Forming of landform architecture as a variety of ecological trend that enables the theory of never-ceasing settlement gardening is considered in works by Karpo [7], Toren [8], Tabb [9], Genks [2], Corner [10].

This issue is examined in works of Zaslkavskaya [11], Shevchenko [12], Denisenko [13], Smirnova [14].

The empiric base to study this theme is presented by works of architects that use the landform approach and architectural planning: M. Sorkin, K. Yeang, E. Ambasz, Sh. Endo, Fr.R.D. Hundertwasser, K. Kum, P. Eisenman and other. Also to study the practical experience the projects of architectural groups—MVRDV (Netherlands), Deca Architecture (Greece), Bercy Chen Studio (THE USA), Chyutin Architects (Israel), Chartier—Dalix Architects (France), GLUCK+ (THE USA), BjarkeIngels Group (BIG) (THE USA), ChartierDalix (France), Signum Architecture (THE USA), Reardon Smith Architects (Great Britain), Grant Associates (Great Britain), Aedas Architects Ltd (China), Studio Odile Decq (France), Jean—Philippe Pargade (France), OFF Architecture (France), Jade + QA (Great Britain), SAALS Architect (Latvia) et al. have been considered.

1.1. *The study is aimed at* exposure and systematization of the ways of building integration with landscape basing on the landform approach.

1.2. *The methodology of the study*. Methods of scientific research used in-process are as follows: evidential analysis that allows to study accessible scientific, literary sources; empiric method for study the practical experience of the investigated objects and exposure of integration ways of objects with relief; the system method by means of which the complex investigation of this issue is possible.

1.3. *Scientific novelty and practical importance.* A scientific novelty consists in an exposure and systematization of integration ways of building with landscapes. As a result of research three types of such cooperation are distinguished: surface, embedded and underground buildings. Building landscape synergy is considered on the example of different types of relief: plain, slope, mountain, cavity. On the basis of analysis the varieties of such integration are distinguished. The obtained results can be of practical use which consists in possibility to use the established ways when planning the landform architecture objects.

2 Results

The beginning of 1990 is considered as initial point of development of the landform architecture, when a nonlinear paradigm and theory of complication were evolved. Ch. Janks, theorist and landscape designer in 2011 in his book “The Universe in the Landscape” put into practice the term “landforms” [2]. His understanding is based on architecture and landscape design, where landform is created in accordance with natural processes and includes the elements of modern sciences and technological development.

The architecture landform of is a trend in architecture, that realizes the organic approach to morphogeny and the spatial organization on the basis of integration of an object with earth [2].

Landform architecture is examined as a new transformation approach of integration of natural surroundings with artificial environment. Practician and theorist of the landscape design Jenkson [2], in his research indicated that landform architecture united the architectural form with natural topography in the single integral system. Thus soil is used as finishing and heat-insulating material.

The landform architecture, creating the modern ways of form making, combines architecture, landscape architecture, landscape design, town-planning, building and ecology. Prerequisites of the landform approach development are the number of factors comprising several principals as follows:

(1) Ecological factors that is maximal maintenance of nature; implementation of principle of compensation for losses that damaged the natural landscape by building of a new object; ecological safety of building and integration with nature
(2) Economic factors that is use of energy effective technologies on principle of "clever" architecture, buildings, that have a zero power balance and which can operate autonomously from engineering structures;
(3) Bioclimatic that is consideration of climatic, geographical, seismic, hydrogeological conditions, landscape environment, land forms of an area;
(4) Psychological that is alliance of human being with nature as a factor of psychological renewal and health improvement.
(5) aesthetic this is the harmonious confluence of architecture with the natural and artificial.

Ecological. The ecology problem appears as one of the basic unsolved tasks for development of humanity. In every case contributory influence on the improvement of ecological situation demands individual efforts of every person and development of conscious strategy of construction of a synergy with natural environment. Ecological personality envisages functional interaction of people in the system "man-environment". Principle of indemnification of loss that was inflicted to the natural landscape by building of some construction is offered in the modern creative conceptions. Architecture creates the "second nature" with principle of geo-equivalence. The cultural landscape created by people shall compensate lost of nature existed at its place.

Economic. Use of the energy-effective technologies based on principle of "clever" architecture whilst building of premises with a zero power balance and circulation that can independently function from engineering structures is important. This is aimed at use of electric power, illumination, alternative sources of heat, ventilation that results in the economy of resources while object functioning.

Bioclimatic pre-conditions effect the direct and substantial influence on formation of the landform architecture. The bioclimatic terms include the following:

(1) land morphology—bioclimatic structure responds to character of relief, adheres to the natural bends or deepens under earth melting into it. When necessary the water aquatorium of locality that refers to the special category of landscape shall be considered;

(2) geology of locality—geological structure of terrain, nature of its massive material, hydrological conditions and terms for the greater part determines character of structural decision of a building;
(3) thermal climate as assembly of natural characteristics of radiation, temperature-moist mode and aeration state of environment (intensity of solar radiation, temperature, humidity, speed and direction of air motion, type and amount of precipitations), that determines normative values and bench-mark data to create the supportive microclimate. Bioclimatic approach also represents the factor of use of biological resources of locality: flora, fauna, mineral minerals, water.

It should be noted, that consideration of the separately taken factors does not provide complete environmental friendliness, comfort and resource preservation of the residential area. Therefore the basic criterion of the bioclimatic approach to the planning is a complex system estimation of the terrain factors.

Psychological. Effect of man-nature synergy is well-known and indissoluble. Man and environment present the single social and nature system. Today scientists distinguish a few stages of synergy of nature and man: (1) dependence of man on nature; (2) dependence of nature on man; (3) unities of man and nature [15]. It should be noted, that today humanity is on the third stage—stage of unity with nature. As of today it is already impermissible to examine the nature dissociated from a human being, it is impermissible to consider it only as an environment for existence and source for satisfaction of pragmatic aims. The human consciousness level must be higher.

Aesthetic. An object fits into a natural environment and has an unusual, attractive look; building ensues the natural forms of the earth surface; supports the tuneable confluence of a summary architecture with nature as well link-up of the internal space with the external one.

Several ways are to be noted during implementation of the landform approach in architecture: (1) by the nature of the building - earth surface synergy; (2) by the nature of location of the building reference area in relation to the level of terrene or soil; (3) for morphologic type of a terrain; (4) by the type of composition synergy of building form with relief and natural environment.

While such building the character of the construction earth surface synergy is essential and allows to emphasize three approaches: (1) polarization; (2) hyperbolization; (3) integration (see Fig. 1).

The prime example of the polarization way and minimum affecting on the environment is the house of Albert in California built by the architect in 1955. The house is the result of careful estimation of lithoidal topography of the area and motion of the sun. The primary objective of architect was the careful inclusion of the building in the landscape using local stones and modern materials, such as glass and metal (see Fig. 1).

Building of university library (by architect Denton Corker Marshall, Indonesia, 2011) is the interesting example of earthen architecture based on extravagance where

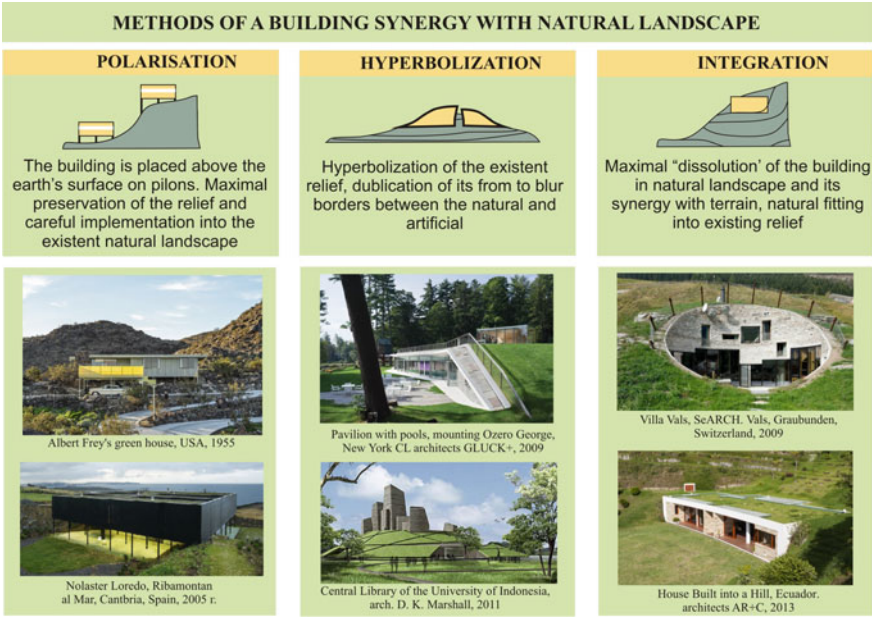

Fig. 1 Methods of a building synergy with natural landscape

successful synergy of natural and artificial environment is shown. The consumption of energy in building is kept to the minimum, collection of sewage and rain waters is envisaged. Green roofs and existent trees provide maintenance of landscape area (see Fig. 1).

Relief is a means of the landform form making. Depending on the location of reference area of building to the level of terrene or soil and deepening in the "body" of landscape the landform objects can be: (1) above-ground (ground, located by a their reference area on the terrene; aligned with rising ground); (2) embedded; (3) underground (see Fig. 2).

Types of half-embedded buildings are appertained to the most widespread in world building practice. They have a number of competitive advantages: the rational use of territory due to the spatial resource, creation of microclimate, wind shield, solar proofing, visual comfort, energy-savings, ecological compatibility etc. As a rule, the half-embedded buildings are erected on areas with flat slopes, if the large volume of soil excavation is impossible (owing to hydrogeological or geological terms, and also economic reasons). The building can rise above the earth surface at 30–40%, and can be embedded at 60–70% [14].

Except it forming of the landform architecture depends on topographical terms of locality—morphological type of the landscape. When the landform architecture is introduced into design the most widespread types of natural relief are flat relief, hill, mountain. Also there are examples of building on the other types of relief: water gap, cavity, hollow, crater.

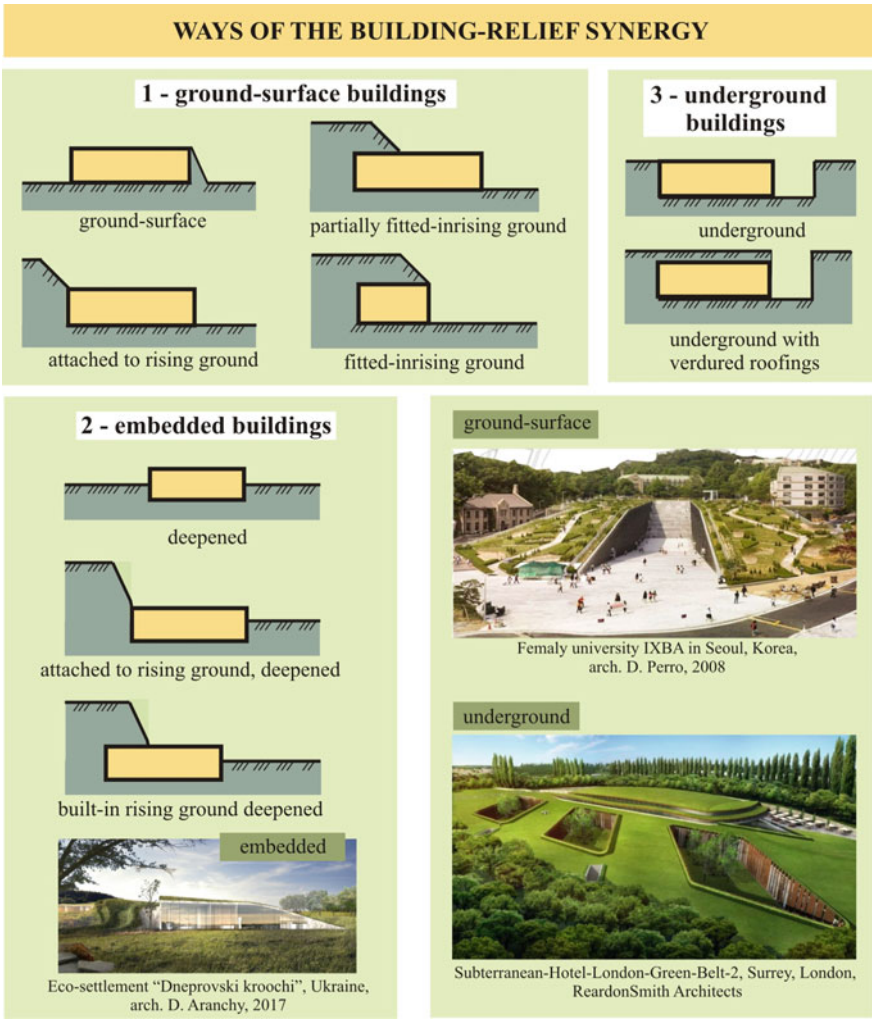

Fig. 2 Ways of the building-relief synergy

When the object form interacts with natural environment and land surface depending on the relief morphology it is possible to emphasize the following compositional ways (see Fig. 3):

(1) *inheritance of the relief form*—where it is possible to singularize the following: nuance—as reiteration of the relief contours by building form and natural landscape; identity—as a complete inheritance of the natural landscape form in silhouette of building, that allows to imbed a building into natural environments softly and without conflicts;

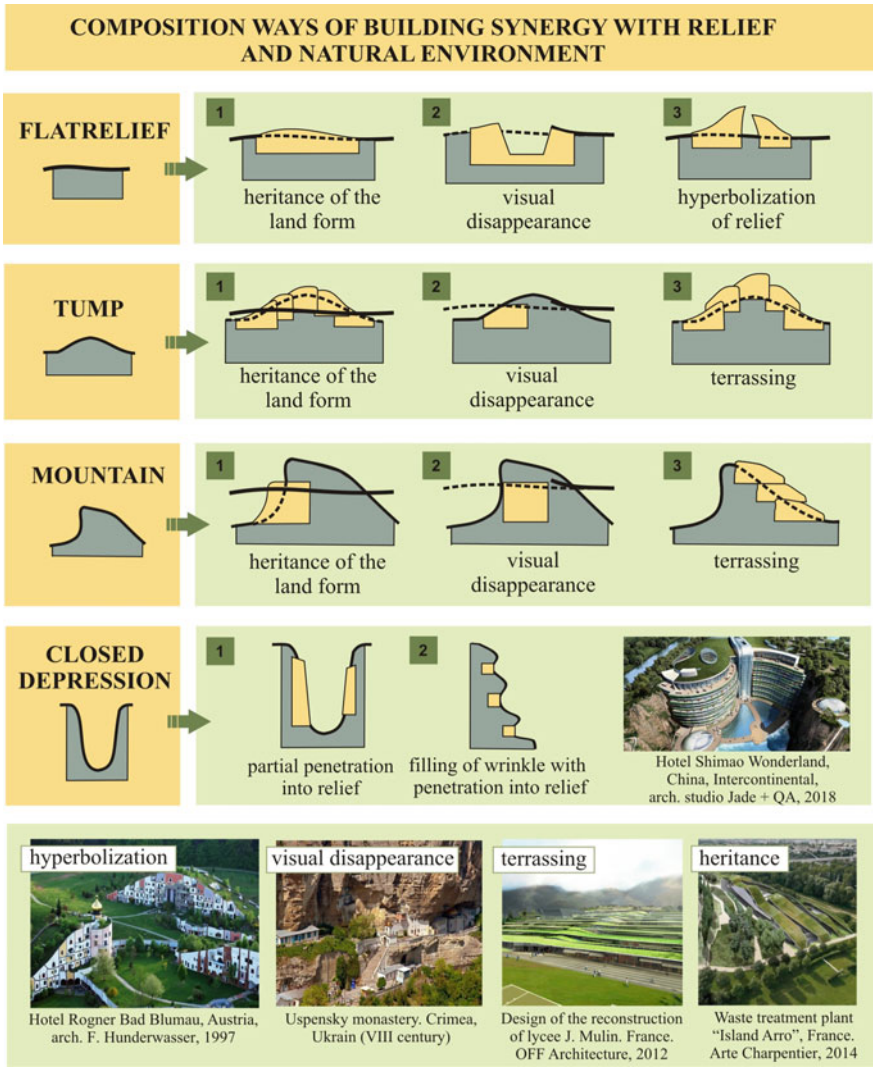

Fig. 3 Composition ways of building synergy with relief and natural environment

(2) *«visual disappearance»*—that is absorption of the architectural object by natural surroundings and its assimilation with ecological structure. Effect of "dissipation", visual "disappearance" of building in natural environment can appear in varying degrees, it is maximal due to deepening, imitation of natural landscape and greenery of facades.

(3) hyperbolization—this is a building which creates the new artificial relief due to exaggeration of the prototype form, use of the planted trees and inclined roofs with greenery. This way more often is used on flat relief. This way is

implemented through the use of geo-plastic as creation of the artificial relief following form of the initial prototype. The building not simply takes place on an area, but constructs area and relief allotted to it;

(4) terracing—this is arranging terraces as wide steps on hills, rising grounds of artificial surfaces with greenery.

The examples of such embedded structures can be the «earthen» houses by the Swiss architect Peter Vetsch. His houses are energy-efficient and environmentally compatible, without square corners.

The extravagance method is typical for landform architecture, whereby building, due to the overstatement of prototype form, use the verdured pitched roofs creates the new artificial relief. This method is more often used on flat relief. It is implemented by geo-plastic way as a creation of the artificial relief following the form of initial prototype.

Building is not simply disposed on an area, but itself constructs the allocated area and relief. One of the form making methods of the landform architecture also is the method of «natural mimetism», when the architectural object maximally imitates, copies natural form. As a result there is visual disappearance or dematerialization of building under the layer of soil and vegetation. The main form making ways here is the geo-plastic and use material, color, textures indicative for this landscape whilst building.

Transformation of traditional architectural form is indicative for the landform approach. Because at the partial or complete deepening in relief, building disappears visually and accordingly loses facades usual for architectural form making. Such building can have one open facade only. Therefore a main form making value in the landform architecture has a natural isomorphism of the architectural object with natural surroundings and relief. It is also necessary to note that the modern energy effective technologies such as geothermal and solar power, wind currents for natural ventilation etc. are used in buildings based on the landform approach [16, 17].

The prime example of steady architecture based on the landform approach is building of Ewha Campus Complex in Seoul, 2008 (South Korea). The building is located in a natural canyon and it masterly entered in the surrounding municipal landscape. The garden that protects internal space from heat and cold is placed on the campus roof. Architect elaborated the so-called “thermal labyrinth”, that includes the great number of the metallic batteries, placed on ceiling and connected with pipes going out outside. It provides circulation of crisp air into campus. A rain-water is saved in special reservoirs and then spreads for functioning of lavatories [18].

3 Conclusions

Thus, finally it should be noticed that a landform building, when using the organic approach, is not situated on the design area but itself builds area and its relief basing on integration with the terrene. There is partial or complete visual “disappearance” of architectural form caused by synergy of the building with relief. The basic task of

the landform architecture is a submission of building volume to the relief form and integrity of its comprehension in the context of natural relief, character individuality, creation of the comfort biopositive structure.

Today landform architecture doing its contribution to the decision of ecological problems of the earth is one of the effective instruments of humanization of municipal environment and careful attitude toward nature. In the modern architectural practice the landform approach is to investigate the enormous amount of displays of landscape and ecology not as the summary phenomenon, but on basis of use of new methods of planning, new formal strategies and technical issues in architecture.

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