



Prefab residential complex with flexibility approach

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Abstract

The purpose of the current research is to examine the concepts related to the prefabricated residential complex with a flexibility approach. The research is descriptive and analytical in terms of research type. In this research, the issue was investigated using the qualitative method and using library research. The use of prefabricated and flexible concepts in architecture has opened a new topic called architecture with ecological architecture or green architecture or environmental architecture. It is that all of these have the same meaning and indicate architecture that is compatible with the environment. Flexibility tries to respond to a wide range of methods used in an environment. In this approach, by taking advantage of the possibility of development, change and multitasking of the environment, the quality of the project designed to interact with the needs of its audience will increase. In terms of flexibility, two different concepts of changeability and adaptability can be distinguished, which are sometimes used interchangeably. The difference between these two concepts can be seen as dependent on the amount of changes that people living in a space can make in it. In the flexible house, a small intervention is possible to make changes, by moving the furniture, while the changeable house is ready to accept the interventions that create a significant transformation in a residential building. In other words, adaptability is summarized in functional and spatial functional flexibility.

Keywords: prefabricated residential complex, flexibility approach, changeability, adaptability

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Introduction

At the same time, architecture has turned towards art and history, and at the same time towards technology and industry. Although modernism, with its emergence, removed many of the problems of classical architecture, such as dense circulation and vast collective space, with the initiative and help of industry and applied sciences. But little by little, the human presence has been forgotten in the midst of the dark and light spaces of the world. Even relatively new topics such as deconstruction and folding (Ardalan, 2018)

In today's world construction, sustainable development is considered one of the most important issues. Sustainable housing development is paying attention to the needs of the future generation while meeting the current housing needs of the community. In the goals of sustainable architecture, the flexibility of

housing design is one of the valuable points. Nowadays, with the change of life pattern and structure of families, people's need for living spaces is changing and transforming. In this way, a family's house of yesterday is no longer suitable for their tomorrow, and not paying attention to the category of flexibility over time will lead to problems such as short life and inadequate functional efficiency of the building and environmental problems with an approach to the past residential architecture of Iran and The type of design and its response to the function and needs of the residents had created comfort and peace in itself. This responsiveness is examined in three processes, adaptability, variability, and variability. In today's buildings, four key factors support long-term resilience. 1-The depth of the building, 2-The accessibility of the building, 3-The height of the building, 4-The level of occupation of the building, each of which plays a role in the form of an effective factor in the

flexibility of the building. (Altman, 1382)

In this research, we use a qualitative method and library research to respond to issues related to prefabricated residential complex with a flexible approach.

The concept of housing

In the past, housing was considered an individual asset and economically non-productive. Today, housing is a type of investment and income increase and has an economic meaning. Housing plays an essential role in economic stability and family well-being, because poverty and lack of economic provision are major factors of social instability. Unlike some needed consumer goods (which creates a kind of balance between supply and demand due to the impossibility of maintaining them for a long time), after providing the basic necessary needs, it becomes capital in the form of savings and fills a very wide area of demand. It reveals that its provision has a different nature from the discussion of housing as shelter.

The main function of housing, in addition to its role as a shelter, is to provide favorable conditions for the family in order to realize family activities. One of the positive consequences of this is the stability and solidarity of the family. Home is the closest space related to humans, and humans experience their first relationship with others in it, and in fact, it is a background for entering a larger society. Lack of access to suitable housing has a lot to do with the increase in delinquency, divorce and social disintegration, and it becomes an inhibiting factor in the growth and promotion of other abnormal social phenomena such as sleeping streets, slums and more serious problems such as begging. (Aivazian, 2016).

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A suitable housing can be a place to relax and rejuvenate, calm the nerves and thoughts in a person, and remove the mental and physical fatigue caused by daily work or make him mentally ready for activities. Lack of housing is an effective factor in the emergence of depression and behavioral and personality disorders, as well as reducing a person's resistance to problems/.

The expansion of communication technology in

different fields will reduce the physical presence of man in different parts of the city and on the contrary, it will increase his presence in housing. In fact, it is possible that unlike the past, the citizen will spend the most hours of the day and night in his home, and his presence in the home and its surroundings will be inevitable and far more than his presence in other parts of the city/.

The housing sector consists of sub-sectors, each of which has its own characteristics and issues. The lack of coordination between them and the existence of defects in each of the elements that make up the housing cause the whole part to lose its coordination and coherence and its performance decreases. The sub-sections discussed in this section are:

1. Land: The problem of lack of land necessary for urban development and the creation of new residential units is one of the main problems in most cities of the world. This problem causes encroachment on agricultural or construction lands in areas that are exposed to natural hazards.
2. Construction materials: lack of construction materials and the absence of necessary standards related to the production of construction materials.
3. Credit and financial resources: lack of sufficient facilities with suitable conditions for low-income groups, lack of access of low-income groups to these facilities and disproportionate distribution of government credits among different income groups are other problems.
4. Manpower: Lack of specialized and semi-specialized human resources in housing matters, their disproportionate distribution in different areas and their concentration and concentration in large urban centers, especially the capital, and sometimes the lack of proper and appropriate use of specialized resources.
5. Construction technology: the rule of traditional behavior, the lack of a construction model related to needs and facilities, the lack of specialized manpower to use advanced construction techniques and machinery, the lack of machinery and workshops for the production of construction tools and equipment, and the lack of proper use of technology in procurement. Housing reduces the construction of more and more housing/ .

Social housing

A famous example of housing that became popular in Iran in the 14th century and with the obsolescence of traditional houses with inner

courtyards is row houses. Basically, this type of housing is based on the separation of parts and individual ownership of the residential plot, and if it contains only one residential unit, it is called exclusive or independent housing. In this type of housing, which is now called villai in the vernacular, a residential unit, no matter how many floors it has, only belongs to one family and it is not possible to use more than one family in it/.

In Iran, due to the change in the consumption pattern in the field of housing and the inappropriate efficiency of private housing due to its high maintenance cost, with the change of urban planning laws and the increase in density, another type of housing and terraced houses is created, which has many architectural and urban planning issues and problems. is. In the same parts of a unit, with the increase of density and density, units are built that share a very small yard (usually the passage and parking of private cars) and several families live in it instead of one previous family. Although this type of housing has walls separating it from other residential parts, it is not private and independent and is in the semi-private category. Unfortunately, many social and economic problems have arisen in Iran due to the non-observance of the humane standards of housing and urban development and the unpredicted spread of semi-dedicated housing, such as the lack of sufficient parking, lack of proper ventilation and lighting in most buildings, and the problems of the following facilities. Urban construction such as sewage, surface water, etc. is. Another type of housing that has not been provided in Iran is terraced houses. This last type is widely used in lands with a lot of slope and problems, which usually has a piece of residential land, dedicated to two or three residential units, which are separated from each other at the entrance, and by using the slope of the land on both the north and south sides for each There is a residential unit with independent access. Or the roof of the lower floor residential unit is the courtyard of the upper unit. Finally, the last type of housing is social or a special type of residential unit that has a common yard in apartment units and can even be built as a single unit on each floor (that is, they can benefit from the advantages of independence of semi-detached and private houses) and in At the same time, they should have enough open and green space and parking/.

The effect of the design of residential

complexes in operation management

In recent years, the demand for living in large residential complexes has increased, the speed of this increase is different depending on the size of the city and its population growth rate. In small and medium cities, most of the residential complexes are established around the cities. These complexes, which are often designed based on the criteria and studies of preparatory plans, include a large number of residential units that are built in the form of a number of 3 to 5-story building blocks on a large piece of land (respecting certain distances from each other). In these lands, despite the existence of residential complexes, the buildings are low and the economy of the land does not justify the construction of high-rise buildings. (Tranova, 1384).

On the other hand, in big cities, the word "residential complex" conjures tall buildings with lots of units in the mind, and the high value of land has made the construction of short and low-floor buildings uneconomical and uneconomical. Household's economic power, culture, construction management and operation management play an effective role in encouraging households to live in residential complexes. The contribution of different income groups and different social strata in using residential complexes is not the same. While in big cities, 10% of the residents of these complexes are wealthy households. In small and medium cities, no wealthy family lives in an apartment./

Of course, it goes without saying that no low-income family lives in a residential complex in these cities. These households have chosen to live in a small single-unit dwelling in the suburbs or cheap areas of the city. Living in special residential complexes is for middle income groups, which has intensity and weakness in different cities.

Apartment living in the country was not created all at once, but the need for housing and the limitation of land made cities and citizens inevitably go through this path, and the words apartment living culture and apartment management were added to the neighborhood dictionary. (Jalili, 13929)

The main stages of designing a residential site

One of the important and effective factors in the form and design of any website is a correct and complete understanding of the exact needs and desires of the people for whom the design is prepared. Of course, the nature of the plan

changes according to factors such as whether the development is private or public sector, the income levels of the residents and the possibility of development (depending on whether it is located in the central area, or the outskirts of the city, or whether it is rural). Although each site needs a special treatment according to its special features, it is possible to search for general elements and principles - in a way that is common to all cases - and examine their most important ones.

The concept of flexibility

It includes many features such as multi-functional use of space, maintaining existing spaces and adapting them to new life needs, changing the size and combination of spaces for new uses, reducing and increasing spaces by changing the area of the building, etc., each of which Among these concepts, which are defined in this research as types of flexibility (variability, adaptability, changeability), they include functional, structural, and spatial aspects, which include such changeable and multi-functional spaces in traditional houses. We also see Japanese. The set of conceptual criteria mentioned in different scales are from the traditional house of Fable discussion and analysis. All the concepts related to flexibility are not of the same "type" and in the same "scale".

Flexibility is defined in the dimensions, spatial and functional components of the house, serving spaces, serving spaces, and communication spaces.

Micro-scale flexibility is involved with finer and more detailed design decisions, so it is of vital importance to users and can be considered at the last stages or at later stages.

The flexibility in the middle scale of this scale is related to the flexibility of the residential unit in how the spaces are grouped to respond to the needs of the household and deals with the main pattern and internal activities of the house. The functional layers of the building and the use of light and natural ventilation are particularly important in this case. Also, the internal and external views of the house and their compliance with the general pattern of formation are also noteworthy points. Macro-scale flexibility Macro-scale flexibility is about the ability to change the use of the entire building as a general unit or major parts of the building.

Flexibility tries to respond to a wide range of methods used in an environment. In this approach, by taking advantage of the possibility of development, change and multitasking of the environment, the quality of the project designed to interact with the needs of its audience will increase.

In terms of flexibility, two different concepts of changeability and adaptability can be distinguished, which are sometimes used interchangeably. The difference between these two concepts can be seen as dependent on the amount of changes that people living in a space can make in it. In the flexible house, a small intervention is possible to make changes, by moving the furniture, while the changeable house is ready to accept the interventions that create a significant transformation in a residential building. In other words, adaptability is summarized in functional and functional-spatial flexibility; While changeability has structural and structural-spatial flexibility. Adaptable designs do not accommodate significant physical changes. In this way, the area of the residential unit is kept constant and all the changes are done without changes in the spaces with fixed construction. (Gulabchi, 2010).

The purposeful design of furniture and precision in how to use them can have a great impact on the optimization of all spaces, especially residential spaces. It should be noted that the furniture industry must go a step further than simply and thoughtlessly copying models from foreign magazines and journals. Entrusting this important matter to people who don't know much about designing in accordance with human ergonomics and also the proper use of space makes them only match the appearance of their products with similar photos in foreign magazines. The result of this type of construction is the usual furniture available in the market of our country; Uncomfortable, bulky, heavy and annoying furniture. This problem has become more apparent in recent years with the shrinking of residential units and has forced designers to invent efficient, practical and at the same time quick solutions. In the continuation of the discussion, it is shown that with a little thought and the use of simple facilities, furniture can be created that, in addition to ensuring the physical and mental health of people, also provides the possibility of multiple use of residential spaces./

Technical and operational issues of prefabricated buildings

Building systems can be divided from the

following points of view:

1. In terms of construction methods

In terms of construction methods, the systems are divided into the following three groups: plate system, frame (skeletal) system, volumetric (cellular) system. carrier or bearer This system is one of the most successful prefabrication methods after World War II. Usually, in these systems, to deal with horizontal forces, central cores made up of cross-bearing panels are used, and these cores are used as space for facilities and services, etc. In the distance between them, separating non-bearing walls - in other words, two different groups of elements - are used. The volume system, which is made in the form of different cells, the same size as the rooms - which are both load-bearing and separating. (Siavashpour, 2013).

2. In terms of the type of materials

Light systems are systems whose specific weight of the constituent materials is less than the specific weight of water. These materials are mainly composite materials, wood and its derivatives such as paper and cardboard, etc. One to two-story buildings with a light system are without skeleton and metal or concrete framing, but in tall buildings, metal or concrete skeleton and covering materials are light materials. Heavy systems are systems whose specific weight of the constituent materials is greater than the specific weight of water. Heavy systems usually weigh more than 1000 kilograms per cubic meter of space, and their materials are concrete, brick, etc. is.

3. In terms of the type of expansion

Closed systems refer to systems in which a pre-fabrication factory produces only the parts used for its buildings and executes and completes its project by consuming them. These systems are not coordinated with other systems, and as a result, its elements are consumed and used only in the same system, that is, it is not coordinated with other systems in terms of size and connection. Open systems, since the main goal in industrial methods and Prefabrication is to reduce costs and economize the building, and due to the fact that in the closed market system, the sale of elements and parts is only limited to the same system, and as a result, sales decrease,

therefore, the open system was created with the harmony between the systems and their components. In open systems, it is possible to receive small orders, while in closed systems, according to what was said, it is necessary to receive a minimum order of one thousand residential units to build a factory. (Danshpur, 1389)

4. In terms of the type of connections

The system with more connections, in these systems, the components are connected in such a way that their connection is completely closed and 100% air does not pass through it. These connections are usually created by filling elements such as concrete. In such a way that a gap is considered at the junction of two parts, where some parts of the parts are involved in this gap, and then the desired gap is completely filled by pouring concrete.

A system with dry joints is called a system with dry joints. In this system, screw and nut connections or welding are usually used. The system with dry connections needs more delicacy and accuracy in terms of connection design, and all connection operations and facilities should be considered in advance. (Shia, 13849).

Connections (assembly) of prefabricated elements

Connection fan is indeed the most difficult problem of prefabricated building systems. Whenever cracks appear in ordinary buildings, it is a difficult task for architects to restore them, but in prefabricated buildings, a large number of cracks are unavoidable and they must be made completely impermeable to water and wind (air). The installation of prefabricated parts requires that distances be considered between them, which have the following role:

- Compensating for changes in the volume of parts
- Compensating the partial movements of the whole building caused by its normal settlement and earthquakes.
- Preventing the penetration of water and wind into the building

Providing optimal thermal insulation

- Creating a beautiful view and specifying the shape of the elements that make up the view

In the early years of pre-construction work, the main trend was to completely block the seams according to the method of normal buildings. But in recent years there was a tendency to leave the

seams open so that there is an outlet for water vapor.

Closed connections, this type of connection is common in almost all heavy systems today. After installing the prefabricated elements in place and pouring concrete around the connecting iron rods, the resulting joint is filled with a special type of mastic that always maintains its rubbery state to some extent. (Sifian, 1376).

Open joints, the reason for choosing open concrete joints is that whenever the facade of the building is exposed to wind pressure, if the wind flow enters a more open space after passing through a narrow seam, it will decrease. This empty space, which is installed in the form of a groove along the entire length of the connection seam between two prefabricated pieces, is called expansion space. On the other hand, it has been practically proven that rain water does not penetrate to a point ahead of the expansion space. In this situation, it is enough to direct the rain outside with a suitable device and prevent the penetration of insects by installing a metal mosquito net, so that the interior space is safe from any external adverse factors.

Aluminum profiles or wooden elements provide other facilities to block the seams.

The degree of accuracy of the measurements and the permissible difference

The installation and connection of prefabricated elements requires a certain degree of precision in the measurements, so that these elements are placed in the building in a predictable way. But this same installation and connection operation requires the presence of a specific playground so that the installation of parts in the designated place can be implemented. In this sense, two types of allowed differences or errors are considered in determining the real sizes of the parts, which we call "errors" for short: production errors and installation or playground errors.

Each part of the building is slightly smaller than the distance in which it should be installed. This slight difference in size is called installation error or installation clearance. The determined distance of the parts in the maps, minus this small playing field, gives the production size, that is, the standard size that each part should fit into. By determining the largest and smallest allowed size, only the sizes of parts that fall within these limits are acceptable. The distance

between this largest and smallest allowed size is called "allowable production error". Creating systems and moving towards construction with elements is only possible by accurately determining the permissible errors (Azizi, 2016).

Transportation

In prefabricated buildings, transportation is extremely important. Prefabricated parts must be loaded and transported from the factory to the building site with a precise schedule. Delay in transportation, failure to observe priority and delay, inaccuracy in loading and transportation will cause many losses to the business.

It is necessary to prevent unnecessary transportation of parts and produce the parts in the closest distance to the construction site. Prefabrication factories in their catalogs each mention a certain radius of operation, which is calculated based on the cost of transportation, the weight of parts, road conditions, etc.

Parts of the roof, roof, stairs, foundation and blocks are transported horizontally, and walls, separating panels and load-bearing walls are transported vertically. Some very long parts are also transported horizontally, such as columns and some high walls. In horizontal transportation, the total weight of the transported parts should not exceed 90% of the weight capacity of the carrier, and in vertical transportation, this percentage should be between 90% and 60%. % is considered. In loading, it is necessary to make sure that the weight of the load is evenly spread as much as possible in the carrier and that the balance is established with respect to the center of gravity of the device, in general, it should not be "pulled".

The minimum distance between the pieces should be 10 cm and the use of rubber bands or wood fillers between the pieces can prevent them from colliding during transportation and causing damage. (Alexander, 2008).

5- Warehousing

In order to have suitable and good workshop conditions, a precise plan for storing and securing parts in the construction site should be implemented. In this program, various points should be considered:

1- A distance of 0.7 to one meter wide should be installed between the piles of parts and a wide axial road in the middle of the warehouse and several intersecting side roads of 25 to 30 meters in length.

- 2- When making piles of parts, it should be ensured that the parts of the same shape and size are placed in one pile.
- 3- The height of each pile of parts should not exceed 2.5 meters.
- 4- The parts should be marked in each pile facing the crossing area, the number and type of parts should be marked by pasting the label in each pile.
- 5- Before finishing the parts of each mass, the parts should be prepared for presentation of work in 2 to 3 days

Conclusion

In the goals of sustainable architecture, flexible housing design is one of the valuable points. Nowadays, with the change of life pattern and structure of families, people's need for living spaces is changing and transforming. In this way, a family's house of yesterday is no longer suitable for their tomorrow, and not paying attention to the category of flexibility over time will lead to problems such as short life and inadequate functional efficiency of the building and environmental problems with an approach to the past residential architecture of Iran and The type of design and its response to the function and needs of the residents had created comfort and peace in itself. This responsiveness is examined in three processes, adaptability, variability, and variability. In today's buildings, four key factors support long-term resilience. The depth of the building, the accessibility of the building, the height of the building, the level of occupation of the building, each of which plays a role in the form of an effective factor in the flexibility of the building. The use of prefabricated and flexible concepts in architecture has opened a new topic called architecture with ecological architecture or green architecture or environmental architecture, all of which have the same meaning and imply architecture compatible with the environment.

According to the changing needs of people, from birth to death, the design of residential units should be such that it responds to the needs of the residents in the best way at any time and can also change based on the needs of the consumer. A residential building with a flexible relationship with the living environment. And it gets its vitality, which is one of the most important qualities of design. Most of the houses that are designed

with flexible housing patterns have the necessary efficiency in terms of space and improve their ability to respond optimally to the needs of the residents. Considering the needs, expectations and desires of people in residential spaces, the living space should be designed in such a way that the meaningful relationship between the living environment and them is taken into consideration/.

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