

ORIGINAL ARTICLE

Structural explanation and investigation of residential complexes using the sustainable development approach

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The housing has always been the most important issue in human beings' lives. Having reliable, secure and comfortable shelter also has been among the human wishes. This this regard, human wished having a house using different techniques and technologies and attempted to improve the creation and development processes. Excessive urban population growth led to the development of mass residential complexes as an alternative to traditional housing in metropolitans. The accelerated progressive growth of the cities and growth of population and following that, increase constructing the houses in majority of residential complexes inconsistent structurally undesirable and inconsistent growth in addition to the qualitative view to the structural elements have been resulted in outcomes. On the other hand, the sustainable architecture and development are among the essential requirements of modern human against consequences of contemporary industrial and consuming world. Protecting the world natural resources, immunity from environmental pollutions, protecting the Ozone layer, physical and mental health, the future of human and etc. are among the most important issues addressed and they are revealed as necessities. In this article, in addition to providing the theoretical foundations of the residence and explaining the residential environment in structural view, the residential complexes are structurally explained and investigated using the sustainable development approach.

Key words: residential complexes; sustainable development; zero energy

From the very beginning of the human live, house was among the most important issues in human beings' lives and as cities developed, it became more important in order to meet users' physical, mental and intellectual requirements. Housing quality improvement is in line with achieving a goal: human comfort. What is important is that all factors involved in comfort are inter-related and considered a single system. The subset of the comfort in general meaning include: mental, thermal, health and lighting comforts. There is an interaction; on the other hand, between social behaviors and structural and artificial environments and; accordingly, the physical environment and structure are mostly important due to their effects on mental comfort and social interactions. Contemporarily, due to limited energy resources, the sustainable development is one of the most important goals addressed in international communities in order to economize and optimize the energy and adapting it brings large economical grounds both from limited energies and economic aspects for states. On the other hand, it is considered the technology and advance level of the states. By sustainable development one means a development which is responsible for meeting the contemporary requirements without damaging the future generations' capabilities. Meeting these needs, particularly in case of energy and considering the future generation's rights to make them employed, demands making informed and particular decisions on energy optimization and consumption. One of the approaches one can use in this regard is to make use of the procedures and methods considered in architectural design. Based on what is addressed, the author structurally explains and investigates residential complexes using the sustainable development approach.

Theoretical foundations of residence

Residence explains the position and identity. Residence is the statement of a meaningful link between human beings and assumed environment which is due to attempt to find identity; i.e. belonging to an environment. As such, human can control

itself when he/she is resident and as a result, he/she has fixed his/her existence in the universe (Noorbari Scholtzer, 2002). The term "residence" is a wider concept than the house and includes a set of living activities of the family. The family's living activities consists of the individual and collective activities on one hand and the social and economic activities on the other hand. In recent years, the importance and role of housing in socioeconomic development have been highly considered and it was determined what the place of this development is in national plans. Hence, it is necessary to investigate the definition of housing in general social objectives. In general social objectives, housing is mostly defined as the meeting ground for human needs. Such a general definition of housing includes the families' residential needs in a plan or certain period of development; while supplying the housing is of higher dimensions. It is sometimes defined as expressing the residents' general goals and requirements. This definition doesn't point to the individual need limits and housing dimensions. In second human housing summit in 1966 in Istanbul, the desirable housing is defined as: "a desirable shelter doesn't mean to have a house for everyone, but it means desirable comfort, space, physical access, ownership security, desirable safety, sustainability and structural durability, lighting, conditioning, suitable thermal system, primary infrastructures such as suitable water supply, health and education, disposing wastes, desirable environmental quality, sanitary factors, suitable and accessible location in term of working and primary facilities all of which have to be supplied based on people's capabilities" (Dalal Pour Mohammad, 2000). Sufficient and nice residence means a house not lower than the standards. This definition highlights the physical criteria such as equipment and building's dimensions, piping and other facilities. The definitions and conceptualizations such as standard, excessive crowd or housing quality and etc. differ between states and each community defines the housing based on its socioeconomic situations. Therefore, in a more complete word, we face with following concepts in general housing needs and objectives:

1. Shelter: the preliminary concept of the housing addresses the need to have a healthy shelter. As food, shelter is an essential living need and this is a social families and individuals' right to have a shelter.
2. Housing and family: the residential unit is the focal point of the family. The residence has to have sufficient space for eating, gathering, sleeping, activities such as children's homework and other essential activities. Discussing the effect of housing on occupational efficiency, stability and family development and growth is addressed at this point. The consistency and conformity feeling to the residential units are among the family's stability and social unity which is significantly important.
3. Economic concept: The house plays significant role in family's well-being and stability. Therefore, this is of a strong social aspect; because poverty and lack of economic supply are among the main social issues and instability. The occupational opportunities, the distance between workplace and house and transportation costs are the most essential economic effective factors on housing. The house means a type of investment in economic conceptualization.
4. Association: one of the effects of house is the family's association with the larger community. Making neighborhood relations for citizen results in significant effects and the social neighborhood relationship is one of the sustainable aspects of urban living. Coherent and sustainable communities can take responsibility of the cooperative projects by their participation and provide the healthy well-being situation. Generally, the housing plans have to minimize differences in social texture.
5. Residential environment: the need to feel included in a desirable residential environment and being in a residential space with accessibility to equipment, facilities and sanitary, educational, shopping, religious and cultural services is of high importance.

Therefore, it can be explained that the housing general objectives in national development plan emphasizes on needs and desires which finally leads to life quality improvement and social well-being. However, the living quality is different between countries; it is emphasized as a general goal (Dalal Pour Mohammad, 2000).

Residential environment in term of structure

House is the protecting factor for the family foundations and the members' interaction (horizontal relation) and the residential environment encompasses the inter-families and neighborhood interaction (general relation). The residential environment is where the child and surrounding environment consistency is provided and the child can be prepared to enter the larger community. Hence, the nature and organization of residential environment doesn't have to be in contrast with the human nature and in addition, this environment has to meet individuals' material, health and mental and social needs. This environment has to meet needs such as protection, stability and independency, conformity to environment, self-expression, aesthetic needs and harmony of shapes and colors, being provided with landscapes and desirable views.

There have to be a sound relationship between the residential unit and the building volume encompasses it. The environment surrounded by tall and large building out of the human dimensions is undesirable in health specialists' view. The most important aspect of the environment is to provide suitable grounds for child and surroundings conformity. Children's needs are varying in different ages and the residential environment has to be responsive to these needs (Shehu, 2017). In order to provide more suitable residential conditions, the residential complexes in no manner have to be constructed in polluted regions without sufficient lighting. The first and most important point to note is the freedom space in proximity with the house with direct accessibility. Open spaces has to be where little children don't need to pass the roads and streets to access them. By the way, these spaces don't have to be far from the natural individuals' commuting places. It is necessary in residential districts to separate the streets from sidewalks. A sidewalk exposed to noise and commuting hazards cannot be desirable place for neighbors' meeting and interacting. In addition, it is necessary in a residential complex to predict a space for people's social interaction and gathering. A multi-purpose simple building seems sufficient for this goal where individual can gather. It is possible to use it as a place for big family reunions which is not possible to be held in the house and it is better to construct it near the small trading center for meeting the individuals' daily requirements (Tahoori, 2002).

Residential complexes

The importance housing complexes is one of the main balancing factors of the human community and in fact, the family's housing is one of the most basic human community's components (Ramachandran, 2017). Accordingly, housing is one of the basic family's requirements which has to be responsive to human's desires; because lack of each of desires and requirements in a residential unit leads to crisis and lack of coordination in entire social life system and lack of house is a barrier to form and healthily grow of the family (Rasooli, 1996). Since having house is an inevitable issue, there have to be decisive actions take so that different groups are provided with situation in which is it possible to meet their demands and requirements for housing based on social rules. The idea of residential complex originated from Denmark and its emergence depended on 3 factors: 1) anti-culture sustainable movement in 1960s as an increasing factor of social life demands, 2) orientation toward and support of communities toward the residential complexes with low density and elevation in small-scales, and 3) new pressures following the social, economic and population changes on families. The residential complexes can be considered with large number of residential blocks including different house types (single-family, low-elevated apartments and tall apartments). In these complexes, the apartment blocks are placed on a land based on pre-planned map. The other feature of these complexes is certain and determined and separate limits from the surrounding urban texture which, in some cases, they are indicated as a structural and social island in the cities (Azizi, 1996). All the apartments constructed previously, provided the residents with a shared residential complex for daily services. These services include access to several types of utilities such as kindergartens and children restaurants. The former one is very important for working parents. Besides these services, the shared complexes have to be responsive to change of families' forms, new lifestyles and social interactions the first shared residential complexes were constructed from early 1970s, but since 1970s, there have been over 100 complexes constructed and many are also being constructed. Different plans of these residential complexes are based on the open space types so that it can be determined which outdoor environments types and open spaces re more responsive to users' perceptions. The essential role of outdoor in first place is to respond to the functionalities (M. Francis, 2003). In other word, outdoor environments or the inter-buildings spaces are consciously designed so that they support for some behaviors by providing the places where particular activities can take place (Gehl, 2011). Making use of the inter-buildings open spaces for some selective, essential and social activities is one of the substantial steps to change the residential spaces to vivid and meaningful places. In fact, based on Francis, studying open spaces is originated from high sensitivity and information on their social failure such as parks, playgrounds, public squares. The results of a decade research confirm the behavioral and symbolic aspects of the urban open spaces, social and mental advantages (M. Francis, Cashdan, & Paxson, 1984). The importance and consideration on public spaces after World War II developed in some states and led many of researches at this time toward the city's public open spaces (J. Francis, Giles-Corti, Wood, & Knuiman, 2012). Gehl (2011) in "life between buildings", believes that it is possible to influence the environment users' number, durability of the functions and how to expand them in environment via environmental design based on some climate and social logics limitations. He divided the outdoor activities in open space to 3 classes:

- Necessary activities: More or less, essential activities such as going to school or work, shopping, waiting for bus. Because the users have no more options, these functions less are influences by physical environment.
- Selective activities: If the time, space and climate conditions and the environment let, these activities are voluntary like walking in clean air, observing commuters and etc.
- Social activities: these activities depend on others' existence and presence (greeting, speaking, public activities, and unconscious contacts such as seeing, hearing). This means that these activities are taking place without predetermined plans and their occurrence is following people's presence in a place and at a time. These activities can be supported when they are necessary and can provide the selective activities with a more desirable environment to take place.

Types of residential open spaces

It is confirmed in literatures on environment that designers are dependent highly on the types when thinking about the buildings plan during the designing stages (Lang, 2007). By formation of residential patterns in different countries, different typologies of the residential environment from the complex to block scales and how indoor arrangement to the residential unit, were formed (Biddulph, 2007). A particular typology of the residential complexes also was provided based on the open and closed spaces together. Accordingly, he classified environmental pattern, linear pattern, single and combined patterns.

- Residential complexes with environmental patter are also called middle open space pattern. In some complexes, the residential blocks are formed around an open central space. This composition causes that the main blocks view would be toward the public streets and in back blocks space, there would be private space. The private spaces formed can be shared between several blocks.
- Residential complex with single pattern which is called micro-plans are the complexes in which residential blocks that are often tall, are dispersed separately in the complex site. In this plan, the external environment quality completely differs from the middle open space. Isolated blocks arrangement provides them with lighting and natural conditioning.

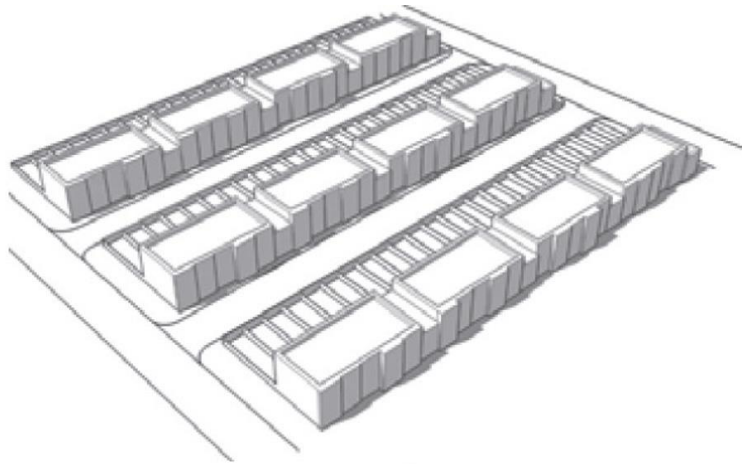


Fig. 1. Residential complex with linear pattern (Biddulph, 2007)

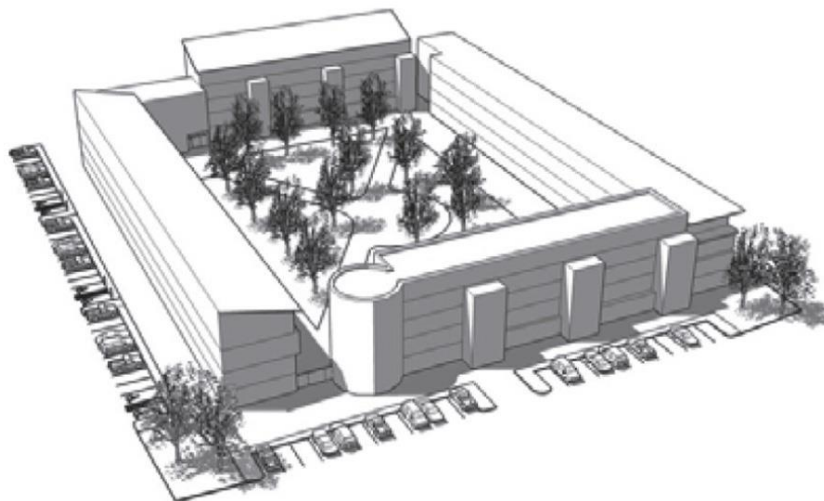


Fig. 2. Residential complex with environmental pattern (Biddulph, 2007)

- Linear pattern is the simplest type of the blocks arrangement in residential plans. The linear plans are usually influenced by the land form or other factors such as being places along with a boulevard or urbanization norms of the region.

- Combined pattern in residential complex is usually a combination of 2 or 3 types of environmental, single or linear patterns. Because the open space in this pattern doesn't significantly differ from open space quality in other patterns, this is out of the scope of this research.

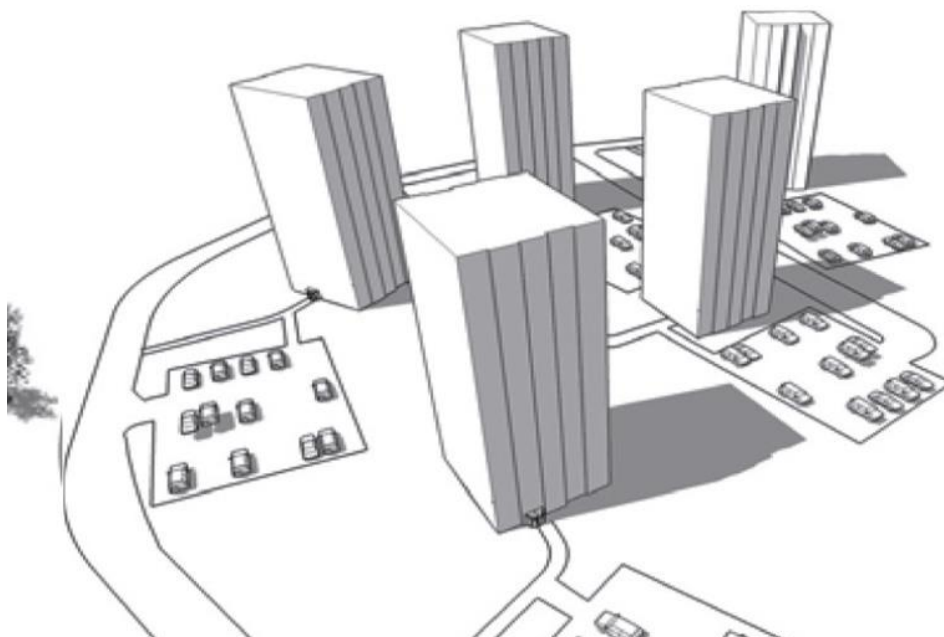


Fig. 3. Residential complex with single pattern (Biddulph, 2007)

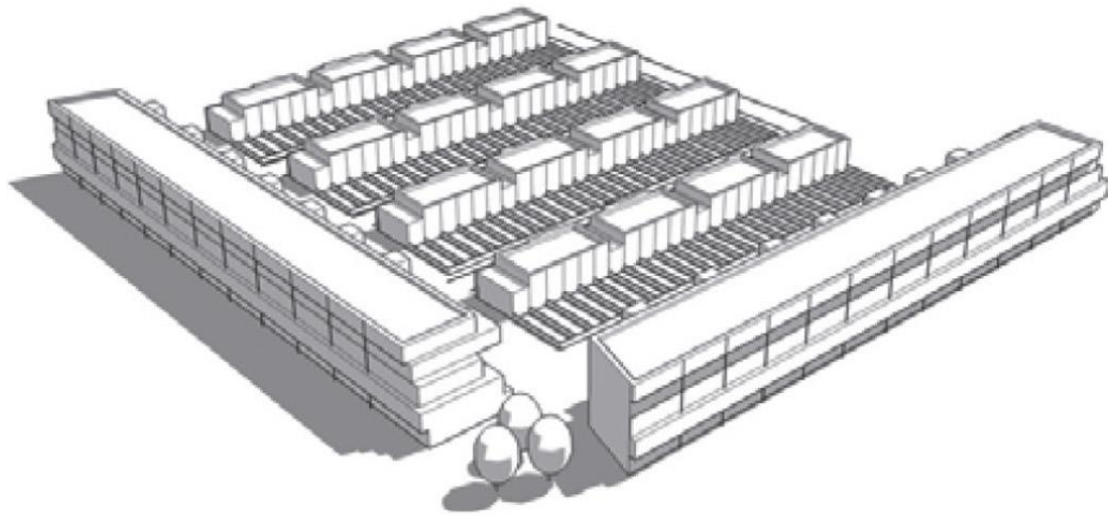


Fig. 4. Residential complex with combined pattern (Biddulph, 2007)

Sustainable development and architecture

Identifying the environment and architecture is only possible by understanding human activities in surrounding world and the main goal of architecture can be creating the human ideas in a structural form. Human design is the main basis of the sustainable designing which investigates existence of all composing elements of the global life system (Sun & Taplin, 2017). This principle deeply stems from the need for protecting elements of the existential systems chains and on which the human beings' sustainability and survival depend. The most necessary role of the architecture is to create and construct environments in which the security, health, physical comfort, mental health and residents' efficiency are sustainable (Armaghan & Gorji Mahalbani, 2009). Sustainable development decides to make important changes in human and nature relation understanding; but the solutions provided in this line regarding the architecture and constructed environments are mechanical solutions and didn't lead to human's ideology and view on the nature and the relationship between human and nature would not be completely and correctly defined (Gorji Mahalbani & Yaran, 2010; Rego, 2016). For this reason, architects attempted to find new solutions for more human's desirable life in line with other scientists. It is evident that life, work, entertainment and rest all are activities which are conducted in spaces designed by architect. Since there is a direct effect from weaknesses and strengths of the building on world ecosystem; architects are heavily responsible in this regard (Soflaie, 2004).

Zero energy buildings

The buildings in which the energy production and consumption is balanced using the Department of Energy of America are called zero energy buildings. These buildings are artistic expression of the efficient energy designing principles and equipment which is combined with in situ recyclable energies production and produces energy in 1 year equal to its consumption (Lee, Gurung, & Brick, 2012). Out of the Canada and USA borders, zero energy building is identified generally as a building with zero greenhouse gases as well as a building with zero carbon emission and making use of the recyclable energies in situ. The need for energy consumption reduction as a part of the approach to reduce the environmental tensions has been widely accepted and addressed. Large energy consuming buildings are contemporary; the energy consumption in developed and developing countries in buildings is about 20-40%. For reducing the negative effects of the buildings constructed on the environment, there is a need to make use of the materials with lowest effect on the environment. The primary studies indicated that buildings consistent with environment can be suitable options in energy consumption minimization and in order to achieve this goal, one can make use of the materials to make us reached them. The smart materials with high capability and consistency with environment can make a matching between building and environment and provide lower energy loss and reduces the negative effects of the constructions in environments. Selecting type of material for being used in buildings differs in different situation. Implementation and costs play important role in selection; but final selection is often made based on the appearance, aesthetics in term of the construction, considering the human resource skill, availability of or locality of the material and facilities to make use and buy them. But in modern architecture, there are other points such as consistency with environment, correct reaction to the natural and environmental factors; energy consumption and material recyclability are among the issues with significant importance. Therefore, in modern construction industry, the materials are mostly accepted as the parts of the designing via which one can select a combination or structure. Under these conditions, many researchers reached the point that making use of the smart materials can be a suitable solution for achieving these objectives (Mehregan, 2011).

Conclusion

Excessive urban population growth led to the development of mass residential complexes as an alternative to traditional housing in metropolitans. This change of pattern is an important change in residents' lives. Contemporarily, open spaces in residential complexes play diverse roles in social lives of the residents in addition to be a suitable alternative to yards and their role in residents' private lives. As large complexes construction increased in Iran as well as passing the quantity-orientation to the quality-orientation in cities particularly in Capital city, the need to conduct a research on how the open spaces respond in

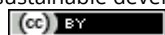
these complexes to the individual, social, cultural, mental and physical needs of the residents became important. During recent century, there have been many experiences with and achievements and valuable changes in architecture and environment which, of course, provided many challenges. But, it can be stated that in turn of 21th century, the world situation reached an unsustainable development whose characteristics are population growth, consumption growth and unbalanced distribution of the resources. Population growth also adversely affected the natural environment which over time led to climate changes, ozone layer cavity, destruction of the natural species and systems. This issue changes the human attitudes toward the nature. Following these changes, the concept of sustainable development emerged and draws commentators' attention to the environment and architecture interaction and the bilateral effects on each other as sustainable development in architecture. Therefore, the architect can make important changes in this area by new attitudes toward nature. Of course, in recent decades, there have been provided useful solutions by architects for solving the problems; however, there are again challenges the sustainable architecture faces with.

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