Housing Sustainability in Tehran's Detailed Plan for Distressed Areas (Case Study: Mazaheri Neighborhood in Tehran 15th Municipal District, Iran)

Mahsa Mostaghim

PhD Student of Urban Planning, Urban Planning Department, Najaf Abad Branch, Islamic Azad University, Isfahan, Iran

Corresponding author's Email: Mostaghim.mahsa@yahoo.com

ABSTRACT: House is one of the primary and basic needs of any family in all societies. In most countries (including Iran) the governments are responsible for providing the house for their citizens. An important aspect in all housing plans is to consider the inability of mid- and low-income families in providing their own needed house independent of the government's help and support. Accordingly, this research aims to find a solution for the following question: to what extent the suggested housing plans in Tehran distressed areas help fulfilling the sustainability of the houses? The methodology of the research is descriptive-analytical. In this regard we first study and define the concept of housing sustainability and its different aspects through library method to extract the factors of the house sustainability. Then we identify these factors in the distressed fabric of Mazaheri neighborhood in Tehran's 15th municipal district. Then we compare the situation of the housing in the neighborhood against the suggested plans by the government, specifically Tehran's Detailed Plan. Finally, we evaluate the scale of housing sustainability in the mentioned detailed plan using goal achievement matrix. The results of this research show that the suggested housing plans in the Tehran's Detailed Housing Plan has been formulated without paying enough attention to the sustainability. Although this plan relatively leads to the improvement of the physical situation, but it fails to fulfill the expected sustainability. Moreover, among all different aspects of the housing sustainability, we found that the socio-cultural dimension has been neglected more than the other aspects of sustainability.

Keywords: Distressed Fabric, Housing Environmental Sustainability, Housing Economic Sustainability, Housing Socio-Cultural Sustainability, Housing Physical Sustainability

INTRODUCTION

Although housing plans are commonly implemented in the urban distressed areas, but in Iran, such plans regard the housing category of the distressed areas as the housings in non-distressed areas. Upper-handed proposed plans such as Tehran's Detailed Plan and other practices in the field of housing in distressed areas mainly focus on the physical dimension rather than the residential culture of the residents and their financial ability for fulfilling such plans. This is why the problems such as the social crimes and identity crises in these areas are still prevalent despite the physical renovation of the mentioned areas.

This is while many distressed areas on Tehran have some positive non-physical characteristics such as the strong neighborhood relationships and sense of belonging to the neighborhood due to the long history of residing in the old areas. The mere attention to the physical aspect of housing in the distressed areas will lead to cultural values and collective memories. On the other hand, the environmental problems (such as the high density of population) and economic problems remind us the necessity of paying inclusive and comprehensive attention to the houses in these distressed areas. Besides, the importance of sustainability for equal distribution of the urban services makes necessitates the sustainable housing.

In this regard, this research aims to identify the effective factors on the sustainable housing and to investigate them in Tehran's Detailed Plan for Distressed Areas focusing on Mazaheri neighborhood in Tehran's 15th municipal district. We hope this research reveals the shortages of the mentioned detailed plan in considering the sustainability in the housing planning.

MATERIAL AND METHODS

Since the subject of the housing includes both qualitative and quantitative aspects, in this research we have used both qualitative and quantitative methods.

This research intends to search and identify different aspects of the sustainability in Detailed Plan on the distressed areas and to specify the weaknesses and strengths of the Plan with regard to the subject of sustainability; so this study is an applied research. On the other hand, we have used the following methods and instruments for collecting the needed data:

a- Questionnaire: considering the social nature of some aspects of the sustainability and the importance of the people's attitude toward the housing planning, in this research we used a questionnaire for understanding the attitudes of the people.

b- Library method: we have relied on library sources for studying the theoretical framework, literature review and studying the selected areas of our case study.

c- Field study: we have relied on field observations and visual perceptions to understand and analyze the different aspects of the selected areas.

The statistical population of the research includes all residents of the northeast part of Mazaheri neighborhood containing different age, gender and social groups. The statistical sample was determined by simple random sampling method. The sample size of the research includes approximately 10% of all residential components of the region, equal to 89 residential components.

Theoretical foundations

Sustainable housing: House is the most important element in any city. One of the most fundamental aspects of the urban sustainability is the sustainability of houses. Housing development not only affects the environment, but it affects the economic, social and cultural aspects of the cities. The main problem in the housing sustainable development is to pay attention to the needs of the future generations while meeting the needs of the current generation for the housing. The housing provision of the current generation must has the minimum change on the natural environment so that it lets the next generation to provides its needed house optimally (Mahmoudi, 2009). In his book titled *Sustainable Housing: Principles and Practice*, Brian Edwards defines the sustainable housing as "housing that meet the perceived and real needs of the present in a resource-efficient fashion while providing attractive, safe and ecologically rich neighborhoods" (Edwards, 2000).
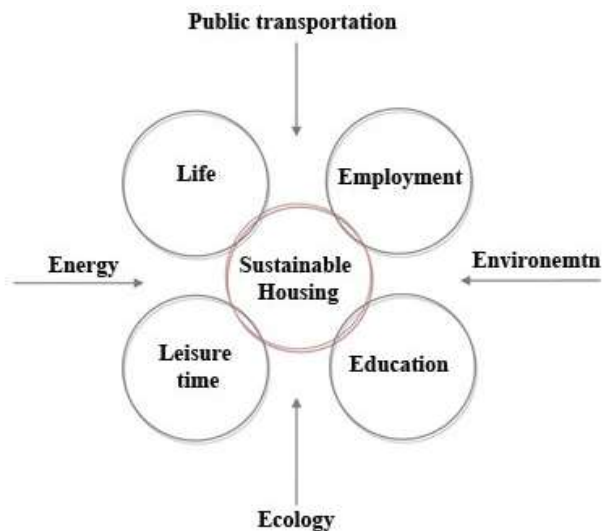
Figure 1. Relations between sustainable housing and other relevant fields (Edwards, 2000)

### The sustainable development of the human housing must have at least 4 dimensions:

-Housing has to be environmentally sustainable
-Housing has to be economically sustainable
-Housing has to be socially sustainable with regard to the culture of its residents
-Housing has to be physically sustainable with regard to its performance

Housing environmental sustainability: Environmental sustainability of the housing relates to the costs that the development of housing imposes to the environment. These costs are imposed during the construction and operation of the houses depending on the fields that are defined in 5 steps of any building cycle:

a-Project definition and planning
b-Project designing
c-Construction
d-Operation
e-Maintenance and repair (Mahmoudi et al, 2009).

Another important point in relation to the environment sustainability is the energy consumption which emphasizes on the reduction of fossil fuels and using more efficient energies in housing. For the reduction of the energy consumption, some solutions have been proposed such as "the application of the heat and/or solar energy, building high-density houses in order to minimize the heat loss, reducing the consumption of the electricity energy by using low-consuming lightings and installing solar heater packages (Edwards, 2000).
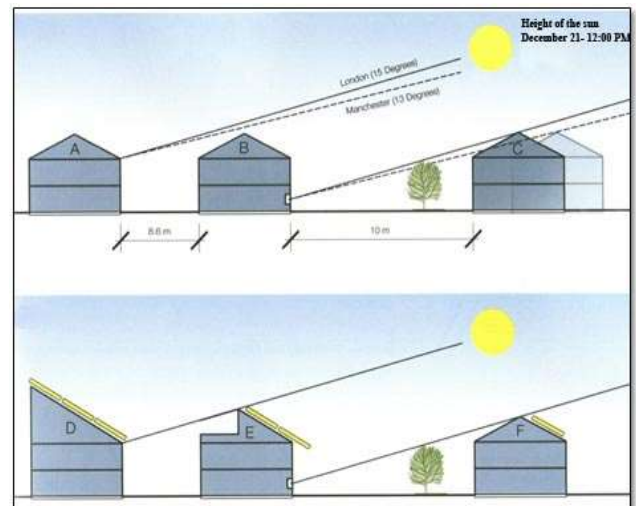
Figure 2. Proposed solutions for the reduction of the energy consumption in the buildings (Thomas, 2005) (**Upper image:** determining the distance of the buildings in terms of the angle of the sun; **Lower image:** Using solar panels to generate the electricity)

Housing environmental sustainability: Since the house construction is a productive process, to be sustainable, the construction industry has to be profitable. In other words, the housing projects, especially the mass construction housing projects have to be financially justifiable. On the other hand, the houses have to be affordable and the buyers have to be able to purchase the houses. Coordination between these two points (i.e. the profits of the constructors and the making the houses affordable) requires special planning. This coordination must not reduce the health environmental qualities. The development of the technical knowledge, using optimal construction materials, and precision in the designing may meet the financial justifiability of the projects without imposing any undesirable environmental effects to the environment (Mahmoudi, 2009).

Housing socio-cultural sustainability: One of the main causes of the destruction of environment is the

change in the architectural patterns during last decades so that the mentioned change of the architectural pattern from the environment-friendly pattern to the modern industrial technology-based architecture has deteriorated the role of the natural environment and its interaction with the artificial environment in the formation of the architecture and urban development. This problem led the citizens to the loss their sense of belonging to the natural environment. Consequently, the urban development based on the modern architecture system led to the destruction of the environment.

Nowadays, the increase of the mentioned crisis forced the authorities to think to some solutions for conducting the social behaviors of the people and making them closer to the nature and environment. If the people get more familiar and willing to live a more environmentally sustainable life, the planners and authorities will be more willing to respect and consider the environmental issues in choosing the place of the project, its design, etc.

Researchers believe that the fair housing policies must increase the customers' right of choosing and the potentials of the housing market, and avoid the policies that make the benefit for limited specific groups while damage the opportunities of other groups for providing their needed housing (Mahmoudi, 2009). In this regard, the social selection is critically important. The housing development plans have to result in houses that belong to all groups, not separating some groups from the other groups which can lead to social disorders.

Housing physical-functional sustainability: Finding optimal direction for the buildings and blocks is the most important challenge for the physical sustainability of the housing. "Wind and sun direction are effective factors in determining the direction of the buildings and street patterns" (Madanipur, 2002). "In order to exploit the advantages of the sun and daily light, the buildings are usually constructed in western-eastern direction, though it is more acceptable to construct the buildings in northern-southern direction" (Gause, 2007). Northern-southern direction minimizes the usage of heat and maximizes the application of natural light during the day. The other important point relates to the priorities of locating the buildings to maximize the usage of sunlight during the winter.

Another challenge for the sustainable housing is the problem of density because the optimal density will have considerable positive effects on the energy consumption and will reduce the expenses of providing the infrastructures. In case of the changes of the residents' conditions, the houses must be adjusted with the new conditions with minimum costs and shortest possible time and to meet wider range of the residents' needs.

Although the optimal density depends on the climatic and cultural conditions, but most experts believe that the 3- to 4-floor density is the optimal and most efficient density for the buildings.

This range of changes may require interventions beyond displacing the furniture. Indeed the houses have to be ready for the interventions that make considerable changes in the residential building. The needs of the families are ever changing during the time. A part of these changes refer to the diversity-quest of the people's spirit. Such quest for diversity makes the people change the face of their building. Another part of the changes relates to the values of the society. What seems beautiful today may seem ugly and outdated in future (Mahmoudi, 2009). Accordingly, one of the characteristics of the sustainable housing is its aptness to reconstruction and promotion of its installations which in turns lead to the increase of the durability and useful age of the buildings. Yet another important issue in the physical-functional sustainability is the problem of access. Location of housing near the transportation nodes is a central principle of the sustainable development. The distance of every residential component have to the public transportation system has not be more than 400 m (Edwards, 2000).

Since the streets are the main access points to the sustainable housing, thus it is necessary to create different types of access to public transportation. Moreover, the streets have to be the pathway of the side-walkers and bicyclers as well (Edwards, 2000).

Urban distressed area
The definition of the urban distressed area in this research is the same as the definition proposed by Tehran's Renovation Organization. According to this definition, urban distressed areas are the legal limits of the cities which have at least one of the following characteristics:

-Blocks whose more than 50% of the buildings are decayed and unsustainable

-Blocks whose more than 50% of the streets' paths is less than 6m

-Blocks whose more than 50% of the buildings are smaller than 200m^2 (Habibi, Purahmad and Moshkini, 2007).

Indicators of the sustainable housing
Reviewing the available literature led us to identification of different indicators for specifying the sustainable factors (Table 1). Although in Table 1 we have classified the indicators under environmental, economic, socio-cultural, and physical titles, but the reader has note that each indicator and criteria belongs to more than a group.

Table 1. Criteria and sub-criteria of the sustainable housing

Aspect	Criteria	Sub-criteria	Source
Physical	Agreement between the climate and housing Construction	Northern-southern direction of the buildings for maximum application of the solar energy and day light	Madanipur, 2002 Guase, 2007 Edwards, 2000
		Locating the buildings in the northern part of the land for maximum application of the sun in winter	
		Using local sustainable materials in constructions	
		Using local patterns of the construction	

	Increasing the readability of the area	Clarifying the border of the neighborhoods using separating patterns of density or establishing buildings in different forms	Bahreini, 2004
		Creating a conductive social environment	
		Diversity in the pattern of housing construction at the level of neighborhood	
	Landscaping	Lack of blind spots and presence of semi-active spots	Carmona, 2009
		Considering the continuity of landscaping	
		Considering the view to the natural spots	
		Considering protected pathways	
		Distributing the green spaces to different urban levels and spaces	
	Reducing the need for using private car (reducing demands for urban travels)	Locating the needed land uses as accessible for side-walkers and bicyclers (300m)	Esmaeili, 2011 Gause, 2007 Edwards, 2000 Thomas, 2005 Singari, 2010 Faryadi, 2004 Asqarzade Yazdi, 2010
		Reducing the distance between the houses and the workplaces	
		Extending the public transport stations not farther than 300m from each other	
		Locating the residential components at points with less than 400m away from the public transportation nodes	
		Creating desirable and beautiful walking paths in order to attract the people to walk for meeting their daily needs	
		Providing the possibility of teleworking	
		Accessing to internet for doing some daily affairs	
		Presence of walking and bicycling paths for accessing daily needs	
		Accessing post offices for doing some daily affairs	
	Optimal determination of the width of the pathways	Building the streets in eastern-western direction	Thomas, 2005
		Considering the lighting of the building in determining the width of the pathways	
	Suitable density in accordance with the locational position	Priority of the commercial land uses in the ground and first floor	Bramley, 2009 Qorbani, 2008
		Priority of residential land uses in upper floors	
		Using higher densities the edges of the area	
		Determining the density with regard to the socio-cultural and climatic conditions of the families	
	Considering the functional diversity	Considering a scale suitable to the area	Bramley (2009) Holden (2004)
		Considering the adjacent land uses	
		Public participation in planning, designing and constructing the houses	
	Hierarchical definition of the access network	Considering the taxi and bus systems as connecting the neighborhoods to the urban centers	Gause, 2007 Edwards, 2000
		Considering the secondary pathways with the possibility of the movement of different vehicles	
		Emphasizing on the side-walking network with low-width streets within the area	
		Designing wider streets at the edges of the neighborhood (compared to the width streets inside the area)	
		Designing the road network in a way that changes the speed of the traffic in the residential neighborhoods to 30km/h	
		Preventing the movement of non-local traffic in the residential area of the neighborhood	
		Designing a side-walking network that encourages the stops and breaks	
		Connecting the walking network to all main service nodes	
Environmental	Minimizing the energy consumption	Using recoverable and recyclable energies such as solar, wind and water energies in the buildings and other forms of the urban development instead of unrecoverable energies	Edwards, 2000 Gause, 2007 Thomas, 2005 Bahreini and Maknoon, 2001
		Insulating the houses against the heat and coldness	
		Using local materials in combination with the modern methods of construction	
		Using rainwater for daily routine usages	
	Wastewater	Healthy wastewater treatment	Azizi, 2001
		Refining the wastewater network	
		Using new technologies in wastewater treatment	
	Water	Adjusting the water supply system to the local and environmental conditions	Gause, 2007 Hughton, et al, 2003
		Durable age of the water supply systems	
		Low rate of destructing and damaging the ecosystem	
		Supplying health drinking water	
		Saving the rainwater to be reused	
		Preventing the damages of the floods	
		Controlling the surface waters and strengthening underground waters	
		Encouraging the citizens to consume the water optimally by controlling the water pollution and pollutant resources	
		Reusing the treated and recycled waters	
	Protecting the open	Protecting the available green spaces	Gause, 2007

|	Criterion	Indicator	Reference
	and green spaces	Using green spaces in the roofs of the buildings at in order to increase the per capita green spaces	Hughton et al, 2003 Edwards, 2000
	Minimizing the production of the waste materials	Minimizing the generation of the construction waste materials during the construction of the buildings	Edwards, 2000 Mahmoudi, 2009
		Adaptability of the houses to the different needs of the residents	
	Reducing the noise pollution	Separating the incompatible noise-generating land uses from the residential land uses	Edwards, 2000 Mahmoudi, 2009
		Removing the traffic of heavy vehicles from the local streets	
	Improving the air quality	Using trees and plants in accordance with the local climate in order to fresh the air and moderate the temperature	Gause, 2007 Hughton et al, 2003 Edwards, 2000
		Creating walking and bicycling pathways for accessing the routine and daily needs	
		Locating the daily needed land uses in places where are accessible by bicycling or walking (less than 300m)	
		Locating the residential components in places with less than 400m away from the public transportation nodes	
		Reducing the distance between the houses and workplaces	
		Considering the wind direction in locating the pollutant land uses	
Socio-cultural	Respecting the needs of different social groups	Considering the culture of the residents in designing the houses and selecting the best suitable types of housing for each culture	Edwards, 2000 Mahmoudi, 2009 Gause, 2007
		Deleting the height difference in the pathways and entrances in order to facilitate the movement of the women, elder people, and disable people	
		Relying on the residents participation in planning, designing and constructing the houses	
		Creating suitable play grounds for the kids	
		Providing recreational activities for the youths	
	Reinforcing the sense of belonging to the place	Creating and reinforcing the neighborhood relationships	Bramley et al. (2009) Gause, 2007 Halbwachs,1950 Carmonam 2009
		Encouraging the people to participate in the collective activities of the neighborhood and registering in the people-based societies	
		Conducing the cultural (and religious) ceremonies	
		Repairing and protecting the buildings and activities that play a role in the collective memories of the residents	
		Preserving the available gatherings of the residents in the neighborhood	
	Safety and security	Locating the houses in suitable places out of the flood, earthquake, and other natural and non-natural disaster limits	Thomas, 2005 Edwards, 2000 Carmona, 2009 Azizi, 2006 Singari, 2010
		Supervising the pathways by offering suitable plan for the houses	
		Installing suitable lightings for removing any blind spots	
		Preventing the designing of any blind corners in the pathways and open spaces	
		Not using intensive plant coverage for the public spaces so that such a coverage prevents the view	
		Using nightly land uses in order to increase the continuity of the activities and monitoring the pathways at nights	
		Preventing the construction of the dead-ends alleys and pathways	
		Considering the residential land uses at the upper floors of the buildings in the edges and adjacent to the public spaces	
Economic	Providing economic houses for low-income groups	Creating a suitable form of land ownership (e.g. zero land policy) in order to match the house prices to the financial conditions of low-income groups	Gause, 2007 Edwards, 2000 Hughton et al, 2003
		Using different housing types and different densities in order to be affordable for the low-income groups	
		Formulating and implementing empowerment plans through granting the bank loans to small industrial units, increasing the job opportunities, etc.	
		Formulating some fiscal and financial facilities for providing the house for the families, (e.g. to grant deposit loans, etc.)	
		Preventing unnecessary costs for the houses (e.g. two-wall glasses, anti-fire materials, etc.)	
		Imposing low rate of interests for the bank loans	
		Relying on the residents' participation in the housing construction and using spontaneous cooperation of the residents	
	Financial justifiability and profitability of the projects	Considering the profits of the investors in constructing the houses and considering the suitable bank interest	Edwards, 2000 Mahmoudi, 2009
		Considering the financial ability of the customers of houses in determining the bank interests, granting the loans, finances, etc.	

RESULTS AND DISCUSSION

Introducing the geographical scope of the research

Geographical scope of the research is Mazaheri neighborhood in Tehran's 15th municipal district in the southwest of Tehran. The limit of Mazaheri neighborhood is surrounded by Tajik and Rezakhani streets from the north, Mansour Street from the south, 17 Shahrival Street from the east, and Fadaeian Islam Street from the west. The total area of the mentioned neighborhood is equal to 7.61 Ha with a population of 23,555. The western parts of the neighborhood near Fadaeian Islam and Boroujerdi have formed based on the workshop and warehouse land uses in the regional, urban and even cross-urban scales while the eastern parts of the neighborhood mainly includes the residential land uses with the activities at local scale. This neighborhood accesses the main roads of the region including Fadaeian Islam, 17 Shahrivar and Mansour streets. The highest

population and residential density of the neighborhood are located in distressed areas. Mazaheri neighborhood is located in the lowlands of Tehran. The level of the underground waters is relatively high due to the flow of several channels of the surface waters. The neighborhood is located near the Rey fault, and a part of the Parchin fault passes within the neighborhood.
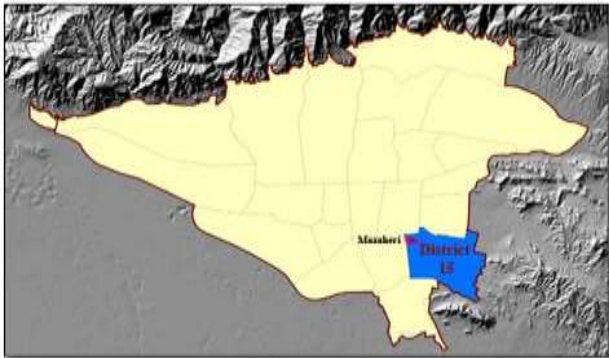
Figure 3. Geographical position of Mazaheri neighborhood in Tehran and its 15th municipal district.

Figure 4. Distressed Area of the research (source: Author)

The distressed fabric of the study is placed in the northeast part of Mazaheri neighborhood. This distressed area is limited to Tajik Street from the north, Saeidi Street from the south, 17 Shahrivar Street from the east, and Ebrahimi Street from the west. The total area of this distressed fabric is equal to 6.7 Ha with a population of 3982 (Census 2006) with 4.6Ha of built level. The eastern edge of the area includes commercial and educational land uses at regional scale. The dominant land use of other edges is mainly commercial. The mentioned area has been formed during 1955 and 1965, thus it has a marginal and distressed fabric.

It is to be mentioned that in the study areas, residential land use (30.5Ha) has occupied 6.69% of the total area while the road network and open spaces (51.1Ha) has occupies 19.86% of the total area.

Housing sustainability in the scope of the research

Housing physical sustainability: The Development Plan of Tehran's 15th municipal district refers to the consolidation of the population, the distribution of the population in different areas and neighborhoods with regard to the capacities and facilities of each area and neighborhood in order to provide the needed services of the residents and to reduce the population density of the distressed areas.

The mentioned plan predicts that the number of the resident of mentioned area will reach to 4739 individuals up to next 10 years with regard to the annual growth of 9.1%. Considering the suggested density by the Detailed Plan for the residential area, its occupational level and the new plan for the road network, the total area for residential land uses will reach to 2422.7 m^2. On the other hand, considering the current family size and residential per capita of 18m2 for each individual (accessible per capita in the distressed area), the relevant extent will have the capacity of 4023 individuals and 1146 families. This value contains 716 individuals lower than the population growth. Thus in the time horizon of next 10 years, the predicted population of the Detailed Plan for the mentioned area will face more 716 individuals. This means the shortage of 204 residential components and thus the insufficiency of the services and facilities.

The population of the area will be increased from 3982 to 4739 individuals, meaning a population density of 622 per Ha. This density shows a dramatic increase compared the current situation (523 individuals per Ha) and the suggested Detailed Plan. Thus despite the goals of the Detailed Plan, not only the population and population density will not be consolidated, but it will be increased. Moreover, another goal of the Plan that is to reach a high quality of the urban environment will not be fulfilled at all. Based on the abovementioned analyses, Tehran's Detailed Plan for the distressed areas doesn't meet the principles of sustainability.

Table 2 shows the current indexes of the housing compared to the indexes suggested by Tehran's Detailed Plan.

Table 2. Comparing the housing indexes of current situation with the indexes suggested by the Detailed Plan (Source: Authors, based on official data bases)

Index	In the whole area (current situation)	In the whole area (suggested by the Plan)	Estimation using exponential method
Population	3982	4023	4739
Land area with residential land use (Ha)	3046.5	5106.4	47390
Number of families	1132	1146	1350
Family size	51.3	51.3	51.3
Number of residential components	995	1146	1350
Per capita constructible residential area	19.63	18	18
Residential occupational level (%)	66.95	60	60
Residential constructible level (HA)	7.8206	10.82544	8.5302
Net residential density (individual per Ha)	750	891.89	-

Based on the officially published data and the author's perception and analyses, although the suggestions of the Detailed Plan state the reduction of the residential area from 5.3046 Ha to 4.5106 Ha, but the residential real constructible area will be increased from 7.8206 Ha to 10.82544 Ha, meaning the increase of the residential density from 750 to 891 individual per Ha. This residential density is not consistent with the concept of sustainability. This is while the occupational level will be reduced from the current 66% to 60%.

Another criterion for the sustainable housing is the roads network and public transportation network. Tehran's Detailed Plan introduces the 15th municipal district as a district with desirable quality of transport and easy and suitable access of residents to active urban points. The most important objective of the development of Detailed Plan in the area is the improvement of road network and its performance by doing some changes in the function of the road network and displacing the cross-local traffic (i.e. removing the passing traffic from the area and conducting it to highways in the edges of the area) and to improve the road network by hierarchical organization of the road and calming the traffic in the area. This is why the Detailed Plan pays so much attention to the organization of the cars and calming down the traffic by the traffic management.

The suggested road network of the Detailed Plan is consistent with the current network while it only emphasize on the widening the streets. In the proposed Detailed Plan, the roads level will increase from the current 19.86% to 32%. Such increase is mainly the result of widening the roads with regard to upper-handed regulations (minimum width of 6m) and the rules and regulation of the regional development pattern for the distressed areas. Although the goals of the Detailed Plan and Regional Development Pattern on the movement of cars will be fulfilled in this plan, but it seems the road widening up to 32% is not necessary because the increased level can be used for other urban services and even for housing. Thus we can consider the design of the current road network merely for ease of access for the cars. Moreover, the suggested plan will inevitably lead to the increase of the car speeds and this reality is in contrast with the traffic calmness of the area. On the other hand, the suggested plan neglects the equipped and mixed streets of the neighborhood and the currently active neighborhood streets (such as Amir Ebrahimi and Mazaheri streets) have been considered as mere residential. Thus it is not justifiable to use a single neighborhood mapping and dividing the area to place-centered neighborhoods. Moreover, although the plan facilitates the aiding services and improves the movement of cars and increases the permeability within the neighborhood, but the car traffic in the roads as suggested by the Detailed Plan will lead the reduction of social interactions within the area. Currently, the streets and walking paths are the place for the interaction of women, gathering places for the elderly, and places for children's play. Such interactions are supported by the sense of security due to the lack of car traffic, while the implementation of the suggested plan will weaken such interactions and gatherings.

Walking network has several problems as well. Unfortunately no consistent and integrated network has been considered in the Detailed Plan for walking. Currently the situation of walking network in terms of accessing the different land uses is suitable although the low width of the sidewalks led the pedestrians to enter the car pathways. But in the Detailed Plan there is no reference to the sidewalks and the way of their organization. Moreover, other issues such as the emphasis on the side-walking movement, reducing the car movement, reducing the distance between the houses and workplaces, and predicting the public transportation stations within the area are completely neglected.

Figure 5. Road network in the suggested Detailed Plan

In sum, with regard to the current situation of the road network, the Detailed Plan has only relied on widening the streets. In this plan, the walking and car access in very unreadable; and the overlapping of these two pathways has led to the reduction of walking safety and undesirable interferences. Although the widening of the streets would lead to the increased per capita of this land use, but it doesn't obtain the expected permeability and we still face with dead-end pathways in the area. Thus the communicative network of the area in the Detailed Plan lacks a consistent and flexible structure with regard to the spatial organization of the studied area.

On the adjustment of the constructions with the climate, the direction of the housing in the area is relatively compatible to the climate of the region and it seems that the wind and sun direction have been effective factors on the housing directions. The general northern-western direction is consistent with a principle that implies the façade of the buildings have to be southward to receive the maximum level of the sun radiation. On the other hand, the placement of the buildings on the northern part of the land is compatible with the climate of the region because it can use the sun optimally in winters. Accordingly, all buildings of the region have a suitable lighting. The Detailed Plan refers to the northern-southern direction in constructions.

As shown in Figure 6, the current spatial organization of the area is not suitably readable. Unfortunately the Detailed Plan has neglected this point. Thus the suggested Detailed Plan not only doesn't improve the current situation, but the widening of the roads and increase of the car traffic will lead to area to be more unreadable.

Figure 6. Spatial organization of the studied area

Landscaping ant its relevant sub-criteria is the other physical indicator that has been neglected in the Detailed Plan. This is while the landscape can play a very effective role in the housing sustainability because of the decay of the fabric and the oldness of the buildings.

Housing environmental sustainability

The most important environmental problem of the studied area is the lack of water surface disposal and the problem of sewage. The position of the 15th municipal district and the traffic of heavy cars in the area have led to the increased environmental pollutions in general and air and noise pollutions in particular. Tajik Street (north of the area), Abofazeli Street (center of the area) and Saeidi Street (south of the area) are usually crowded by the heavy cars. This traffic imposes a sever noise pollution to the residential fabric of the area.

Recently, the surface waters collection system has been completed in the studied area and thus the surface waters of the houses are conducted to the channels. This channel network has been formed gradually as a part of the streets. Generally, most pathways of the area lack a suitable system for collecting and disposing the surface waters. Indeed despite the presence of channels for collecting the surface waters, the water flows still can be seen in the streets at the times of raining. According to the Detailed Plan, some part of the wastewater of the area is disposed through the absorbing falls. These parts that are mainly located in the east and north of the area are considered as the pollutant sources due to their undesirable urban face and the air and soil pollution. The placement of some industrial plants in the area has increase the penetration of such pollutants to the inner parts of the area.

In terms of the garbage collection, the studied are is similar to other neighborhoods of Tehran. Since the weather of this area is relatively warmer than the other areas, the stench of garbage is a serious problem of the area. On the other hand, the health conditions of the surface waters disposal network and the accumulation of the garbage in the mentioned network leads to dramatically deterioration of the health of the area.

Figure 7. Placement of the industrial units within the area (*source: author*)

The Detailed Plan refers to some goals such as transferring of incompatible and polluter land uses, reducing the traffic size by establishing roads at the edge of the area, extending the green spaces, organizing the physical-spatial dimensions of the region, and revitalizing the old area in order to exploit the complete potentials of the area for improving its livability and extending the network of infrastructural installations, especially the network of surface waters collection and disposal. Although these goals have been formulated in order to improve the environmental and health conditions of the area, but some defined goals and activities are awkward. For example, the car network has been designed in a way that conducts more car traffic to the area and consequently it will lead to more air and noise pollution. Although the placement of industrial zone in the west of the studies area (in order to displace incompatible land uses) solves the problem of those land uses in relation to the residential ones, considering the wind direction (western-eastern) in Mazaheri neighborhood, the mentioned displacement leads to the conduction of industrial pollutions to the residential fabric. Of course some complementary activities (such as increasing the green spaces and predicting needed suitable installations and equipment) can improve the health conditions of the residential fabric.

Among all suggested points in the Detailed Plan, it seems that the direction of the buildings and placement of the buildings at the northern part of the lands have the highest effect on the environmental sustainability in the studied area.

Housing economic sustainability

The studies show that the resident families in Mazaheri neighborhood are mainly among the low-income groups of the society (mainly income deciles of

1-4) and so they financial ability is weak. Consequently the financial ability of the residents doesn't allow them to participate in the renovation of their neighborhood.

According to the authors' calculations and filed observations in May 2012, the average annual income of residents is approximately equal to 5.52 million IRR (approximately 1850 USD). That is, the average income of the residents of Mazaheri neighborhood is approximately one-third of the average incomes in Tehran.

Since the relative poverty line for 2011 has been declared as equal to 900,000 IRR per month (approximately equal to 300 USD per month), thus we can claim that 97% of the residents of Mazaheri neighborhood live below the poverty line.

A main criterion of housing economic sustainability is the provision of cheap and affordable houses for low-income groups of people. This point is particularly important in the urban distressed areas. According to World Bank standards, the affordable price of the housing has not to be 3-6 times more than annual income of the family. This is while in the studied area, the average price of a 50m apartment (with regard to family size of 3.5 and residential per capita of 18m) is equal to 60 – 65 million IRR (approximately 20,000 – 22,000 USD) that is approximately 12 times more than the average annual incomes of the families. These values show the low financial ability of the residents and unaffordability of the housing in the studied distressed area. The researches show that 82% of the respondents were owner and the remaining 18% were tenant. Thus the renovation of this distressed area will require the protectionist policies due to the low financial ability of the residents. According to Articles 3 and 4 of the *Instruction of Granting Housing Loans in Urban Distressed Areas* (2011), "banking facilities will belong to those introduced citizens whose scale of participation includes at least 100 m^2 after the reconstruction. These facilities are assigned only for constructing residential components in form of the civic participation. These facilities don't require any deposit". This is while in the studied area, about 36% of the components have an area of -50m^2; 42% have an area of 50-75 m^2; and remaining components have an area of +75m^2. By and large, the area of 92% of the components in Mazaheri neighborhood is smaller than 100 m^2. Thus for receiving the mentioned banking facilities, the residents have to aggregate 2 or more components to form a single component. This action seems very problematic (if not impossible) with regard to different financial power of the residents. Unfortunately, the mentioned instruction is equal for all areas of Tehran without considering the financial differences of the residents. On the other hand, the positive point of the abovementioned banking facilities is that they are granted without any interest rate.

Another criterion for creating affordable housing is to rely on the residents' cooperation in the construction of residential components. Cooperation here not only means the financial participation, but it includes activities that the residents can do for constructing their own residential component. According to available statistical information of the 15th municipal district, 7.4% of the residents are involved in construction industry and thus their capabilities can be used for the plan, but the Detailed Plan has ignored the mentioned point.

One of the most important criteria of the housing economic sustainability is the financial justifiability and profitability of the housing projects. That is, the housing projects have to be profitable for the investors while considering the financial power of the house customers in determining the rates of banking interests, financings, etc. With regard to the governmental supports of the constructions in distressed areas and providing banking facilities, the banking system will be involved in the financial provision of the housing and constructional projects. In order to understand the procedure of the financing for the construction in the area, consider an example. Suppose that two owners live in the area each of which has a land with the area of 85 m^2. If the owners want to construct their land themselves, they will face two problems. First, they don't have the financial power for the construction; and second, the municipality won't allow them to construct because their land area is lower than 100m^2. Thus the rational solution for the first problem is the presence of an investor, and the rational solution for the second problem is the coalition of the two owners.

The total area of the two lands will be equal to 170m^2. If we suppose that the area of each land will be reduced 10 m for the street widening plan, then the remaining total area will be equal to 150m^2. Suppose that the mentioned lands are placed in R121 extent and thus their constructional density will be equal to 240%. Considering the occupational level of 60%, the mentioned lands will have an area of 360m^2 for residential construction and 90m^2 for the parking lot. Thus the owners can build 4 residential components of 75 m in the remaining area of 150m each of which with a parking space and a warehouse.

According to our field observations in May 2012, the average price of each 1m^2 land in the studied neighborhood is equal to 1,000,000 IRR (approximately 335 USD) and the average price of each 1m^2 apartment is equal to 1,300,000 IRR (approximately 435 USD). Accordingly, the price of the whole land will be equal to 170,000,000 IRR (approximately 56,700 USD) and the share of each owner will be equal to 85,000,000 IRR (approximately 28,350 USD). If the expenses for constructing each 1 m^2 residential component is equal to 400,000 IRR and for parking lot equal to 250,000 (approximately 83.5 USD) then the total costs of each project will reach to 148,000,000 IRR (approximately 49,333 USD). Thus the total cost of the project will be equal to 318,000,000 IRR (approximately 106,000 USD) among which the share of the owners will be equal to 51% (25.5% for each owner) and the share of the investor will be equal to 49%.

Table 3. incomes and costs of the supposed project in May 2012

Subject	Value	Unit
Cost of the land	170	Million IRR
Cost of the construction	148	Million IRR
Total cost	318	Million IRR
Sale income	3.495	Million IRR
Investor's interest	69.91	Million IRR
Total interest	72.60	%
Annual interest	48.40	%

Supposing the price of each 1m^2 for the residential component (33m^2) is equal to 3,100,000 IRR, the total value of the project at the time of sale will be equal to 3,495,000 for each 1m^2 with regard to the growth rate of the housing prices (18% annually according to the official statistics of Iranian Ministry of Housing[1]). Since 49% of this value belongs to the investor, the share of the investor will reach to 697,242,000 IRR. Considering the cost of 151,000,000 IRR (148,000,000 +3,000,000 IRR for loan interest), the construction of the building will have a profit of 91,000,000 IRR resulting from the participation for the investor. This profit is equal to 72.60% of the construction costs and loans repayment (costs by the investor). This is while if the investor deposits his money (148,000,000 – 80,000,000 bank loan = 68,000,000 IRR) in bank, the interest of his deposit at the end of 18 months will be equal to 77,400,000 IRR. Thus the investment in the construction will be profitable for the investor. Accordingly, the renovation project of the distressed area will be profitable and financially justifiable.

Housing socio-cultural sustainability

Socio cultural sustainability of housing is "to consider the needs of different social groups", to increase the sense of belonging to a place", and "safety and security". An important point in the socio-cultural sustainability of housing is to respect the residential culture, values, and norms of the local residents in determining the suitable pattern of housing. The residential density in the studied area included 1 to 2-floor buildings. This density is consistent to the life style of the residents. In most residential components, kitchen and WC are placed in the yard. Washing the cloths and dishes and a part of the cooking is being done in yard as well. Thus the yard of the buildings play an important role in the life of the residents. The obtained results of the questionnaire confirm the mentioned point. According to the field observations, 86.5% of the respondents prefer to live in a house with yard instead of living in apartment. This finding asserts the importance of the yard in the life and culture of the residents. Moreover, installing the curtain at the entrance of the buildings shows the importance of privacy in the studied area. On the other hand, neighborhood living is crucially important. The elderly and women spent a considerable part of their time with their neighbors in front of their houses. The results of the questionnaire show that the neighborhood communication is the third common way of spending leisure times in the studied area. Such communications is more important for the women. About 21% of the female respondents stated that they spend their leisure time with the neighbors.

The Detailed Plan only talks about general issues without referring to suitable pattern of housing in terms of the socio-cultural aspects. It refers to the prevention of watching inside the other buildings and to the increase of open public and private spaces without clarifying the

issue. Moreover, in design of the pathway network has neglected the public and semi-private performance of some available spaces in the neighborhood (such as the dead-end alleys as the places for neighborhood communication and children's play while such a neglect will practically lead to deterioration of such performances (such as the public performance of some side-walks and their importance in the social interactions). Besides, no alternative has been predicted for such vanished public spaces. This can cause several social and even psychological problems for the residents. On one hand, the suggested density (240%) and the way of apartment residence is not compatible to the residential culture of the residents and can lead to some problems for the definition of privacy for the apartment-resided families. For example, the use of common yard in the apartment and the possibility of watching other floors from the balconies can be problematic. Such problems can make the residents to change the face of their component, or to cover the balconies. Moreover, the Detailed Plan has not predicted some behaviors such as spending the leisure times in front of the doors or using the yard for washing and cooking. In sum, although the residential culture of this neighborhood is fundamentally different from other neighborhoods of the 15th municipal district, but in practice the suggested pattern by the Detailed Plan is the same as suggested for other neighborhoods.

The results of the interviews with the residents show only 1.50% of the respondents have been settled in the neighborhood for more than 20 years. Besides, more than 57% of the residents have stated that they will leave the neighborhood in case of having better financial power. These points indicate the lack of the sense of belonging to the neighborhood due to the lack of facilities in the area. According to the results of the questionnaire, only 42.43% of the residents have a memory in the neighborhood. Among the women, 33.83% of the place-related memories refers to their presence in the mosque of the neighborhood and 17% of the memories belongs to the events happened in the streets. The corresponding memories for the men are equal to 74.67% and 32% respectively. Thus widening the streets will damage the sense of belonging to place seriously because it will ruin the place of collective ceremonies and social interaction and public participation.

On the subject of social security, according to the neighborhood residents and based on the authors' observations, the studied area is one of the most crime-full areas in Tehran with a high rate of disorders such as drug abuse, drug smuggling, and the theft. Parks and dead-end alley are among the most unsecure places of the area. The lack of lighting in the streets reinforces the severity of the situation. Moreover, the lack of supervising the streets from the houses in the dead-end alleys has made such alleys a suitable place for criminals. Unfortunately, the Detailed Plan has no idea about these problems.

Based on the previous evaluations, the widening of the streets (as suggested by the Detailed Plan) will lead to the improvement of access by the aiding vehicles in emergency cases. Replacing the old buildings with new durable and consolidated ones will increase the

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[1] According to the mentioned statistics, the growth rate of housing in 2011 has been equal to 18-20% (www.anboohsazan.com)

safety of the houses. But the increase of safety is not limited to such replacements. Generally, in evaluating the vulnerability of the urban fabric against the earthquake, there are several factors to be considered: distribution and adjacency of the land uses, population and building density, hierarchy of the open spaces, etc. As mentioned before, according to the suggestions of Tehran's Detailed Plan, the population and building density of the studied area will be increased. But such an increase will lead to the increase of the vulnerability. Another important point in reducing the mentioned vulnerability is to consider the ratio of 1-5 between the width of the streets and the height of the buildings. Accordingly, in streets with 6 and 9 m width, the height of the buildings must not be more than 7.5m and 13.5m respectively. But considering the density of 240% (as predicted and issued by the Detailed Plan), the height of the buildings in all streets will reach to 14m and this ratio can be hazardous and problematic in case of the earthquake.

Evaluating the sustainability in Tehran's Detailed Plan

In order to evaluate the sustainability of Tehran's Detailed Plan quantitatively, we used goal achievement matrix. In this regard, first the levels of the importance of sub-criteria were determined in the criteria loading section. This process included the values 1 to 5 in which the score "5" shows the "very important" and "1" implies the least important. This loading was conducted by the researcher based on the local characteristics of the neighborhood including the economic, physical, environmental, and socio-cultural aspects of sustainability. Then the level of paying attention of the Detailed Plan to the relevant criteria has been evaluated in the section of Detailed Plan loading. Here the scores included the values of 0, 1, 2 and 3 in which "0" implies the lack of paying attention to the relevant criterion, "1" implies a little attention, "2" implies the normal attention, and "3" implies the complete attention of the plan to the relevant sub-criterion. Moreover, the negative values who that the relevant criterion will be vanished by the implementation of the plan. Then in the next step, the total score of the Detailed Plan was calculated (by multiplying the value of the sub-criteria importance to the load of the Plan). The obtained scores were compared to the total score. According to the obtained results, Tehran's Detailed Plan could obtain score 169 out of 972 (i.e. 17%). This evaluation and score confirms the fact that the mentioned detailed plan cannot have a significant role in the housing sustainability.

CONCLUSION

Nowadays, it is vitally important to pay attention to the sustainable housing in metropolises such as Tehran that face a dramatic growth of the population and lack of needed settings for more extension. Meanwhile, the distressed areas are of particular importance as the areas with potential capability of development and extension. In this research we studied and evaluated the effectiveness of urban development plans in general, and Tehran's Detailed Plan in particular with regard to their role in the housing sustainability from the physical,

environmental, economic, and socio-cultural points of view. The results showed that although the mentioned Detailed Plan can be useful in some areas for improving the current situation, by it cannot lead to the housing sustainability. Unfortunately, although the mentioned plan can relatively improve the physical aspects of the housing, but it completely ignores the socio-cultural dimensions of the residence in the distressed area and even in some cases, it leads to the deterioration and decline of some positive characteristics such as the neighborhood communications and the sense of belonging to a place. Moreover, the Plan underestimates the available social disorders in the distressed areas and fails to improve the social security of the neighborhood, while the social security is one of the most important problems for the residents. Environmentally, the mentioned plan neglects the application of new methods for reduction the energy consumption and determining a standard for the quality of the materials. The Plan only refers to the direction of the buildings in this regard. On the other hand, from the economic point of view, although the available financial and banking facilities for renovating the distressed fabrics can lead to the provision of affordable housings for the low-income groups, but since such facilities are equal for all distressed areas despite the physical and economic differences of different areas, such facilities are practically useless and inefficient. Besides, the physical planning for housing has emphasized only on the physical aspect of the buildings and widening the streets based on the standards of Iranian Renovation Organization without considering other aspects such as the improvement of hierarchical accesses, reduction of the need for using private cars, improvement of the readability, and specification of the suitable densities with regard to the local conditions. By and large, Tehran's Detailed Plan has offered some suggestions that are applicable in all areas of Tehran without playing a role in the sustainability of the studied areas regardless of the specific characteristics of Mazaheri Neighborhood as a distressed area.

Competing interests
The authors have not declared any conflict of interest.

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