

A THEORETICAL APPROACH TO CAPABILITIES OF THE TRADITIONAL URBAN FORM IN PROMOTING SUSTAINABLE TRANSPORTATION

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Abstract

Influenced by the early to mid-twentieth century modernization, the Iranian cities experienced urban transformations that laid extensive effects on the social and physical human activities that have remained until today. Mobility is one of such issues that are broadly under the influence of the transformed urban form. This paper claims that the new Iranian urban planning encourages the city dwellers to drive personal cars because the neighborhoods and their centers lost importance after the urban form modernization efforts in 1930-1960. Neighborhoods with districts centers used to be basic elements of the traditional Iranian urban form. This study indicates the capabilities of the small-scale traditional urban forms like neighborhood arrangement in solving modern mobility problems. The theoretical approach that this study discusses over is that strengthening neighborhoods and Neighborhood Unit Centers (NUCs) can promote sustainable transportation, namely pedestrian travels. As a result the urban travels will be shortened and localized. The dominant view of automobile-oriented planning is needed to be replaced by a more humanist strategy, such as neighborhood-oriented planning. This ideology uses the neighborhoods to enhance sustainable mobility. To test this hypothesis, micro-scale and city-scale quantitative and empirical observations are suggested to prove the capacities of neighborhoods and their centrality in making the city-level travels more sustainable and decrease traffic congestion.

Keywords: Sustainable transportation, travel behavior, pedestrian trips, Neighborhood-Oriented Planning, Neighborhood Unit Centers, Iran.

1. INTRODUCTION

The studies on land use/transportation interactions have grown rapidly after 1990. These studies are expected to give planners better understanding of how urban planning and design can enhance sustainable transportation. The ultimate goal is to determine how different urban forms affect transportation. The transportation part can be a wide range of mobility concepts like car ownership, mode choice, pedestrian/bike behavior, travel generation and distribution, etc. Most of the concepts that are influenced by urban form are related to travel behavior. On the other hand, the notions that are in connection with land use can be divided into three main groups that cover a broad range of scales from

neighborhood to large international agglomerations. The first group includes the studies that consider the density impacts including construction, population and employment densities (for example: Cervero, 1994; Cervero, Kockelman, 1997; Dunphy and Fisher, 1996; Ewing et al., 2008; Greenwald, Boarnet, 2001; Holtzclaw, 1990, 1994; Levinson and Wynn, 1963; Newman and Kenworthy, 1989, 2006; Niemeier et al, 2011; Pushkarev and Zupan, 1977; Schimek, 1996). The second category contains those studies that examine all other problems related to land use like location-related issues, socio-economic problems, allocation of different uses, etc. (for Example: Cervero and Radisch, 1995; Crane and Crepeau, 1998; Ewing et al, 1994; Ewing et al, 1996; Fehrs and Peers Associates, 1992; Frank, 1994; Handy, 1993; Hare, 1993; Stead, 2001).

The third category targets all issues about design. The design-related problems can cover the street network structure, neighborhood amenities and facilities, and small-scale urban furniture. Design can be effective on modal split especially in micro-scale. A number of the studies of this kind study the role of neighborhood design combined with higher densities can be influential on modal share (Kitamura et al, 1994). There is evidence that neighborhood qualities like ease of street crossing, sidewalk continuity, local street characteristics, and topography can enhance more transit trips (Parsons Brinckerhoff Quade and Douglas, 1993). Block size and continuity of sidewalks have also found important in reducing the number of trips and Vehicle Miles Traveled (VMT) (Cervero, 2002; Crane, 1996; Ryan, McNally, 1995; Plaut, Boarnet, 2003). The effects of the built environment of the neighborhood have also been examined in relation with pedestrian trips (Cao et al, 2005; Handy et al, 2005). The structure of the street network has also been a target for scholars. The connectivity of the network has been repeatedly addressed as an important factor in promoting slow modes of transport and in reducing travel length and travel speed in Neo-Traditional Development ideologies (Duany, Plater-Zyberk, 1991, 1992; Katz, 1994; Calthorpe, 1993). This idea has been confirmed by some studies (Kulash et al, 1990; McNally, Ryan, 1993). The importance of street connectivity in walking behavior has especially been shown around the transit stations (Özbil, Peponis, 2012).

Unlike land use and density, the share of design factors from land use/transportation research in countries outside North America is very small. This is especially noticed in micro-scale. This is also true about Iran; almost all of the related studies are on city and district scale and the studies on the role of neighborhood design are rare. The present paper targets a combination of design and land use as the main factors of urban form. The effects of the neighborhood amenities, neighborhood center locations, and accessibility to the centers are studied as the main aspects of design, and commercial neighborhood uses and public open spaces are considered as land use measures within the context of the Iranian cities.

With the social and mobility-related problems in the Iranian cities, the necessity of local studies on the role of neighborhood-scale urban design on urban travel behavior is increasingly felt. This paper offers a theoretical approach for indication of the capabilities of traditional Iranian neighborhoods in promoting slow modes of transportation, particularly pedestrian travels. The non-commute trips are especially targeted.

For this, brief information about the historical urban transformations in Iran during the past century is presented in section 3. It is meant to indicate the neighborhood form that let people easily use local facilities without the use of motorized vehicles. Section 4 gives an overview of what the travel-related results of the urban transformations. Then in section 5 it is explained what is expected to happen when human-scaled organization of the traditional neighborhoods is applied in new designs. Also recommendations for conducting comparative cross-sectional research on traditional neighborhoods and new developments are offered. Section 6 suggests research topics for enhancing studies on urban form/travel behavior research in Iran and similar countries in MENA (Middle East and North Africa) region.

2. RESEARCH METHOD

This study presents theoretical ideas for improvement of sustainable transportation in Iranian cities. These ideas are derived from literature review of the urban form of the traditional cities and neighborhoods during the past decades ending in early twentieth century, therefore the paper is descriptive. Recommendations for improving the idea are suggested at the end of the paper. It is attempted to fill the gap between the historical urban investigations of the region and the new wave of sustainable transportation studies. The paper provides with ideas for measuring the possibilities of inherited in compact and central urban forms. The output can be used in empirical studies on cities of Iran. Such theoretical concepts have been explained in detail by the author in Masoumi, 2012a.

3. URBAN TRANSFORMATIONS: CHANGE FROM TRADITIONAL TO CONTEMPORARY CITY IN IRAN

The objective of this paper is to suggest a research framework for comparative study on the travel-related aspects of the traditional neighborhoods and the new districts of Iranian cities. Thus it is necessary to have basic knowledge about urban transformations during the past century. This study sets the hypothesis on the effectiveness of these transformations on changing the travel qualities and specifications. Of course this effectiveness is partial because other factors like change in general

lifestyle, new transportation technologies, other communication tools, socio-economic factors, etc. seem to be stronger. What is important for this study is to show how the traditional neighborhood functioned with a basis of human and how car-oriented the new urban planning is.

3.1. City and Neighborhood in Traditional Iranian City

The form of the traditional Iranian city is similar to the dominant form of other Middle Eastern cities. The form of the organic settlements has provided the residents to live in a compact and human-oriented urban environment. What is called traditional Iranian city was the dominant form of the cities until about 1930s or 1940s. During the first half of the twentieth century the central government tried to change the form and landscape of the traditional cities to industrial and modern ones. Construction of central open spaces and roundabouts, wide streets for automobiles and monumental buildings were parts of this plan.

The traditional city was a combination of several neighborhoods surrounding bazaar as the economic hub of the city. Each neighborhood comprised of some neighborhood units (sub-neighborhoods) that were home to families with similar societal, religious, or occupational relations. Because of living very close to each other, the families gained close relativity and interests during time. There were often no physical boundaries to determine the borders of the neighborhood units, but sometimes it happened to build a sign like an arc to show the entrance of the semi-private space of the neighborhood unit. Nevertheless, the main thing that determined the boundaries was the subjective understanding of the residents. They identified themselves to which neighborhood they belonged. Therefore by talking to the inhabitants of the historical cores that accommodate population, it is possible to collect information about the boundaries and areas of the neighborhoods. In this study, the neighborhood units are studied as the smallest urban area that has a central structure and one or more centers. Almost all of the traditional units have a small center called Neighborhood Unit Centers (NUCs) that was accessible for all of the houses. These centers include local infrastructure, small open spaces, public buildings, and shops/retail. The narrow allies and streets of the old cities became a little wider where the centers located. In many cases the nearby NUCs completed the short comings of each other. Therefore people of neighboring units could use other centers.

By using the above mentioned subjective method of defining the neighborhood unit boundaries, the areas of the neighborhood units of the historical core of Kashan in central Iran have been measured. With an area of 606.6 hectares, the historical core of Yazd in the center of Iran contains 7 large neighborhoods. Each neighborhood includes a number of neighborhood units with areas between 3.6 to 42 hectares. This figure is 1.8 and 23 hectares for the 356.9-hectare historical core of Kashan. However

most of units of these two cities have an area of smaller than 30 to 35 hectares and an area of 25 hectares is normal in most of the cases (Masoumi, 2012b). The hierarchy of the neighborhoods and neighborhood units is like the contemporary administrative divisions. The regions, zones and recently neighborhoods are applied as the geographical and administrative limitations. However the neighborhoods that are now defined are much larger than what there is in the traditional cities.

The small areas of the units enabled the residents to access the central neighborhood amenities and public infrastructure. The unit centers located within walkable distances from the houses. Kashan gives a good image of accessibility to amenities. The walking distance between the center of each neighborhood unit to the farthest house of the same unit has been at least 180 meters and at most 825 meters. 90 percent of the walking distances to the NUCs were less than 670 meters (Masoumi, 2012b). With today's standards the above numbers show high accessibility within the urban form of the historical cores. The important point is that the residents could raise their daily needs from the NUCs and only occasional travel to bazaar for other shopping would suffice.

3.2. The contemporary Iranian City

Under the decision of the central government for demonstration of the modern view of the Iranian cities, the landscape of the cities was systematically changed by top-down planning. The new wide streets prepared the way for cars as a new transportation mode. The urban form was affected by this urban strategy. The form of the street networks became straight and as time passed the grid iron networks were complete. Between 1930s and 1970s the new street networks were semi-grid iron, while after 1970s and 1980s the networks became complete grid iron. The density and compactness of the cities were decreased and planning public open spaces was neglected. Considering the general specifications of the peri-urban areas, it is claimed that many Iranian cities suffer a rapid urban sprawl (Masoumi, 2012c). Although this urban sprawl is somehow different from the western sprawl, but it has so much similarities that it is possible to call it with the same phrase (Masoumi, 2012d). The density of the new developments has decreased compared to the older textures (Masoumi, 2012c; Ghanavati et al. 2012). Therefore in farther places from the city centers the construction and population densities decrease. The leapfrog developments are added to the low densities in the periphery of the medium and large cities. The automobile-oriented sprawl has had notable negative effects on the urban environment, including underground water (Hosseini et al. 2010a; Hosseini et al. 2010b), climate change (Roshan et al. 2010), quality of life (Ghanavati et al. 2012) and even tourism (Roshan et al. 2009). The speed of this sprawl is so that in the case of the city of Yazd it is more than many developing countries (Shahraki et al, 2012).

4. TRANSFORMATION OF URBAN FORM AND ITS EFFECTS ON TRAVEL BEHAVIOR

There has been a reciprocal relationship between urban form transformations and travel behavior during twentieth century in Iran. On the one hand, using new transportation technologies has urged the decision makers to change the urban structure, and on the other hand, the change in urban structure influenced people to use cars increasingly. Along with other social and technological trends, the new streets that were built in 1930-1950 brought new social life and new travel habits to the cities. People could reach their destinations easily on foot until the urban modernization took place. After this morphological change, the distance between the neighborhoods with the potential destinations increased as a result of the growth of the cities and lack of local facility planning. People were driven to the streets to reach the shops, offices and other services. For accessing farther destinations motorized transportation, particularly personal car became the dominant transport mode.



FIGURE 1 - A RECREATION OF THE LAND USE PATTERN OF THE NEW CITY: THE COMMERCIAL AND OTHER USES IN THE NEW URBAN FORM OF THE IRANIAN CITIES ARE LOCATED ON THE EDGE OF THE STREETS, WHILE THE RESIDENTIAL NEIGHBORHOODS HAVE REMAINED WITHOUT ANY CENTERS TO DRAW THE WALKING TRIPS.

The neighborhoods and their centers were especially influenced by these circumstances. In the new urban form, the NUCs did not have the ability to attract short travels any more. People preferred to go to the wide new streets with attractive shops, cafes, cinemas, theatre saloons, etc. instead. Figure 1 illustrates the new arrangement of the commercial uses on the edge of the streets in the new city. Here the strength of the new streets is clearly in contrast to the single use of the residential neighborhoods. There is no sign of the neighborhood centers in the new formation of the cities. As a consequence, the neighborhoods have changed from in-looking to out-looking in terms of urban travels.

However the potential of mobility in the scale of city increased in contrary to the local scale. A recent study (Masoumi, 2012a) shows that the connectivity and integration indicators of the urban configurations after the wide automobile streets were built increased in comparison to the traditional urban textures. Both indicators are Space Syntax measures that show the possibility and likeliness of mobility (Hillier, Hanson, 1984; Hillier, 1999). Integration shows the general capability of urban form to enable people to move through the open spaces. This includes motorized mobility or especially pedestrian travels. The mentioned research also showed that the newly developed areas with new patterns can give people more mobility possibility rather than the organic traditional textures.

5. DISCUSSIONS AND RECOMMENDATIONS

Most of the above studies are done in the scale of city. When zooming on the micro scale, new ideas appear. This section presents a theoretical approach to the advantages of planning centralized communities using traditionally structured land uses. What is suggested here is assumed to have positive effects on shortening the travel distance and accordingly increase the share of slow transportation modes. The theoretical bases should be empirically tested in future studies.

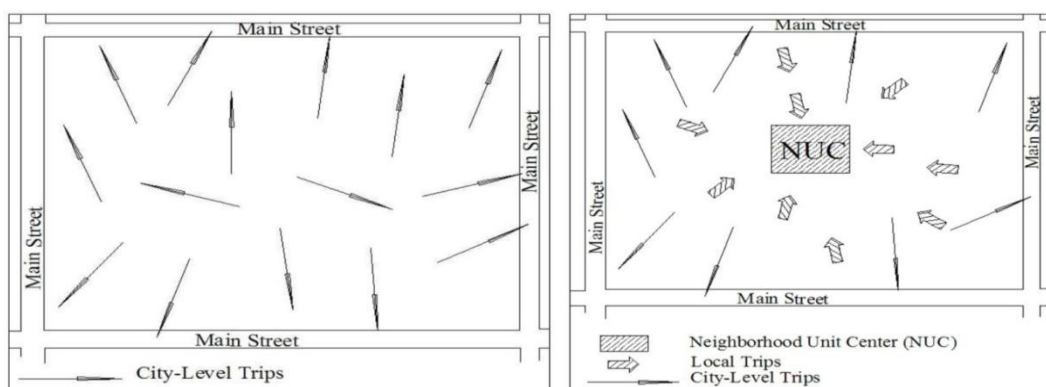


FIGURE 2 - SCHEMATIC ILLUSTRATION OF THE OLD NEIGHBORHOOD WITH A CENTER (RIGHT) AND THE NEW URBAN QUARTERS THAT ARE OFTEN WITHOUT A DISTINCT CENTER (LEFT).

Source: Masoumi, 2012a

The traditional local centers had the capacity to attract the local residents. As a result of the historical urban transformations the neighborhood centers do not have the previous importance any more. In the new urban textures people should travel to far-away destinations for daily needs. Such long travel distances necessitate using personal cars because in most of the cities the public transportation systems do not function efficiently. Figure 2 shows a schematic illustration of the old neighborhood centers and the new quarters that do not have a distinct center. The general specification of the new urban form is that very strong city centers and existence of a number of regional centers in addition to weakened local centers direct people towards very limited number of destinations. Lack of a variety of targets is a general deficiency of such developments. In a descriptive observation, the centers in the new developments can be divided into three main categories;

- The city-scale centers; like city centers and Commercial Business Districts. Such areas act as the most important destinations in the city. Since almost all of the Iranian cities can be considered as concentric cities, the city-scale centers are of particular importance in attracting the urban trips.
- The regional/zonal centers: each city is divided into regions and each region includes a few zones. There are some centers that have an influence area of region or zone (each city includes some regions and each region contains a few zones).
- The local centers: the local centers include the centers of neighborhoods or neighborhood centers (sub-neighborhoods).

This paper claims that adding to the attractiveness and strength of the third group can be a good solution for decreasing traffic congestion. The spatial problem in many neighborhoods is that not only such centers are weak but also in most of the new neighborhoods a collective combination of amenities in an accessible place does not exist. Apart from the advantages related to human perceptions like senses of community and place (Farkisch et al. 2011) and also senses of territoriality and belonging (Farkisch et al. 2012), the neighborhood centers can bring mobility values as well.

The capability of the NUC to attract the trips is likely to be more effective about non-commute activities like shopping and entertainment that can be done in a short distance from the living places. Such travels can be done in the direction of the center on foot or by bike. This idea assumes that people are encouraged to do their daily shopping and entertainment inside their neighborhoods if the neighborhood has an attractive and facilitated center. This can be especially true if the walking distance from the houses to the NUC is quite short. As previously mentioned the walking distances of the traditional Iranian neighborhoods have been normally less than 670 meters. That is comparable to the suggestion

of international neo-traditional urban designers (Duany, Plater-Zyberk, 1992; Katz, 1994; Duany, 2001). The attractiveness of the NUC together with the short walking distances is able to keep many urban passengers inside the neighborhoods and not to direct them towards the main streets to cause traffic congestion. The result will be localization of travels, especially the non-commute trips.

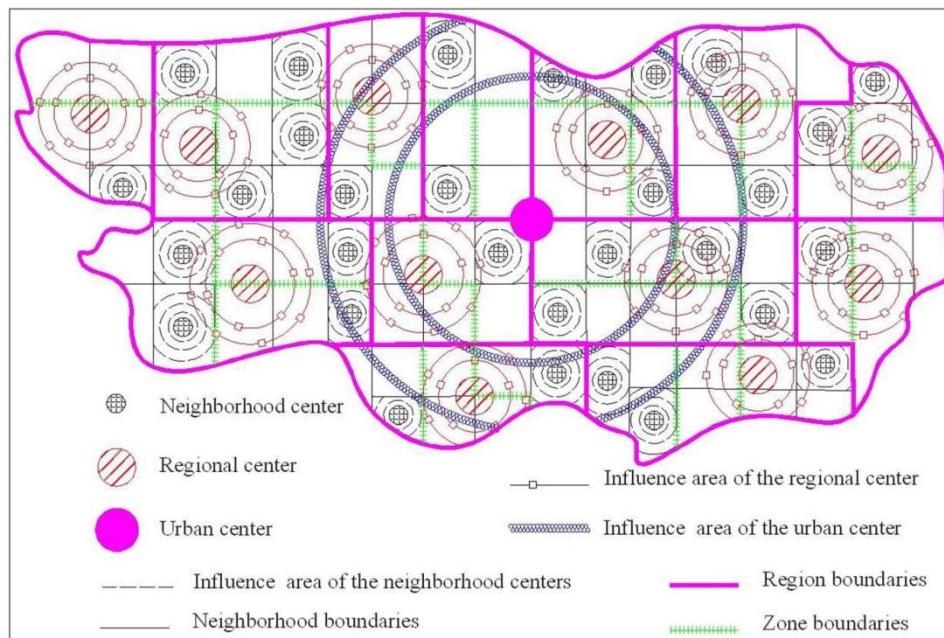


FIGURE 3 - SCHEMATIC ILLUSTRATION OF THE EXISTING CONDITION IN IRANIAN CITIES.

What can be more effective is to study this idea not only in case of a single neighborhood but to the whole structure of the city as a general strategy. Figure 3 shows the existing condition of the urban, regional and local centers within the urban textures. While the local centers do not contain enough amenities to raise the needs of the residents, the urban centers are the strongest centers, which are the ultimate destination of the urban travels. Thus many travels are done not only along the main streets, but also towards the city center. That is a main reason for traffic congestion in the vicinity of the city centers. Three types of centers should be planned; city centers, regional and zonal centers, and neighborhood centers. The city centers and to a degree regional/zonal centers are active in the existing urban patterns. Nonetheless the local ones are rather weak and inefficient. In this figure, the inhabitants of the areas that do not have a local or regional center are urged to use personal cars. Cars are the only option when there is no access to public transport.

To improve the point to the city scale, the above idea about localizing a percentage of non-work trips and keep them domestic inside the neighborhoods should be applied to a large number of neighborhoods of the city. Figure 4 indicates how the centers in different levels can attract urban trips. It

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is important to give the residents various destinations to choose from to promote the multimodal transportation. Here by strengthening the local centers, slow modes would be promoted. The main idea that is raised here is that it is not necessary to increase accessibility through construction of transportation infrastructure like highways or streets, but improving local amenities can also increase accessibility. Implementing such a pattern gives the possibility to decrease the traffic share of the city centers and add this share to the local communities to make them livelier.

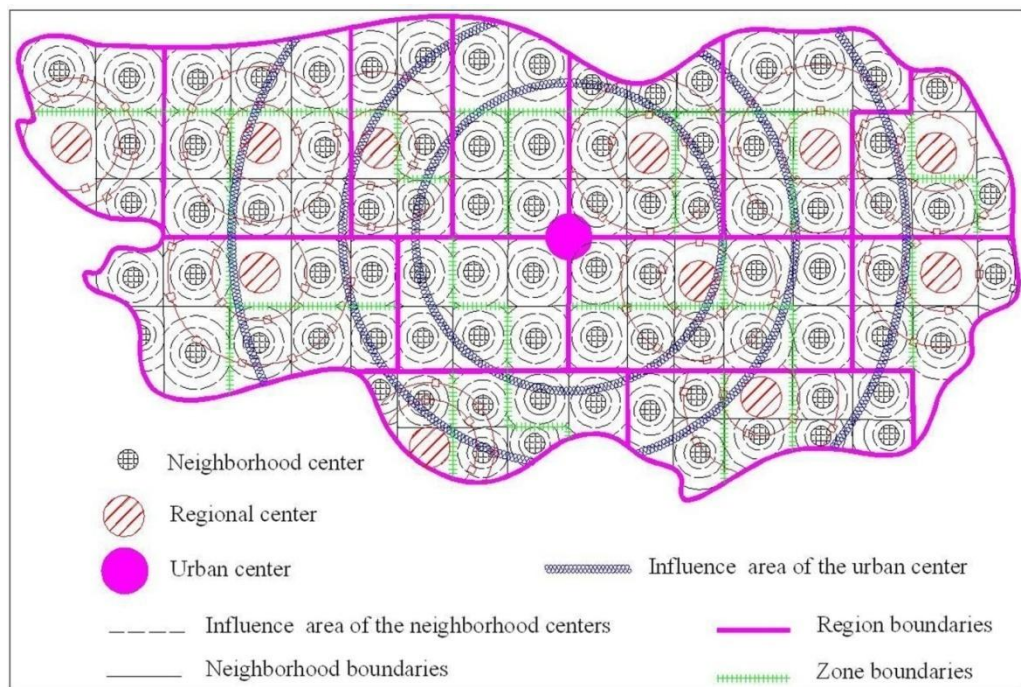


FIGURE 4 - THE SUGGESTED MODEL FOR CENTERS. ALL THE NEIGHBORHOODS HAVE DISTINCT CENTERS THAT CAN ATTRACT LOCAL TRAVELS.

6. IMPACT OBSERVATIONS

To test the significance of the presented theories, the impacts of urban form on travel behavior can be observed in two scales: micro scale and city scale. The micro scale observation is done via comparison between neighborhoods. The neighborhoods that are selected should be smaller than the ones that are defined in the municipal administrative limitations, because the official neighborhoods are so large that they cannot be used to measure the walking behavior. As mentioned about the traditional urbanism, the neighborhood areas should be less than 30 or 35 hectares. The city-scale observation is conducted to generalize the neighborhood results to the city scale. The aim is to show how the city can benefit from the possibilities of the neighborhood centers to attract local residents and promote pedestrian/bike

travels. Such observation indicates if a city with several neighborhoods with this quality can reduce traffic congestion rather than a city with weak local centers and a concentration of functions in the city center.

6.1. Micro-scale observation

The core idea of this paper needs to be put into test by empirical observations. The traffic-related advantages of the neighborhood centers can give good potential to be investigated numerically by measuring travel specifications like travel mode choice, travel length, trip generations and distribution, and the like. The general question that such studies should answer is how much the centralized, compact, traditional urban form is able to not only decrease the share of the city centers, but also increase the sustainable travel modes in the whole city. The neighborhood scale observations are very rare about the Iranian cities.

Two types of residential urban districts can be compared to test the above hypothesis: a) neighborhoods with one or more visually attractive centers preferably on the geometrical center of the neighborhood within walking distance to most of the houses (neighborhood 1) b) residential urban quarters with dispersed, centerless form (neighborhood 2). Neighborhood type 1 is the representative of the traditional neighborhoods. Although such areas may not be old, but they can have the central structure of the traditional neighborhoods that were shaped based on the human size and activities. Neighborhood type 2 represents the new developments that are planned and constructed during the past three or four decades. The examples of such districts are usually seen in the sprawled areas in the periphery of the metropolitan areas. The specifications of the Iranian urban sprawl like low population densities, leapfrog developments, lack of public open spaces, and lack of public facilities (Masoumi, 2012a and b) should be seen in the selected cases of type 2.

There are dissimilarities between the urban forms of the two neighborhood types, as follows:

- Center: the public uses of Neighborhood 1 are concentrated in one place and made a physical centrality, while they are dispersed in different streets and alleys in neighborhood 2.
- Sufficiency of public uses: the center of neighborhood 1 apparently has adequate amenities for the residents, while such adequacy is not clearly seen in Neighborhood 2, or at least we are not sure about the sufficiency before doing the survey.
- Public open space: Neighborhood 1 contains a small public open space like the ones in the traditional city. Such spaces can be in form of an urban park. Neighborhood 2 does not have any such space as seen in most of the sprawled urban patterns.

- Attractiveness: the center of the neighborhood 1 has elements with visual attractiveness. Such elements can draw local residents to themselves. Since neighborhood 2 does not have a center, such attractiveness cannot be seen.

To prepare a significant ground for comparison, the case selection should be done in a way that factors like distance to the city center, and socio-economic indicators like household income, average age, educations, and car ownership should be controlled for. This can be perfectly done when the selected comparison areas are very near to one another.

Such a survey should clarify the differences between the two types of neighborhoods in the number of pedestrian travels, number of the non-commute travels to the neighborhood center and the city center, number of travels by personal cars or by public transportation, self selection of residential location, and the perception of the people about the attractiveness of their local retail and entertainment facilities.

6.2. City-scale observation

In contrary to neighborhood-scale studies, there are more medium-level observations on Iranian cities. Such studies are made on urban Regions (administrative urban boundaries) to city level (Arabani, Amani, 2007; Soltani, Esmaeili-Ivaki, 2011; Shokoohi et al. 2012; Soltani et al. 2012). Some of such observations are also done in inter-city level (like: Mirmoghtadaee, 2012).

It would be necessary to bring the results of the micro-scale observations to the city level. The questions that should be answered here is how a city with cohesive and connected neighborhood centers can generate more sustainable travels that a concentric city with less local centers. The case-study selection is done from two types of cities: a) cities with several neighborhoods and neighborhood units with distinct centers (city type 1), and b) cities with new developments and districts with the dominant specifications of urban sprawl. Such cities have little number of districts with clear centers (city type 2). It will be interesting to have quantitative information about how the city type 1 keeps the short travels inside its neighborhoods, or how the long travel generation/distribution in the two city types differ. The selection may be done according to cultural and socio-economic control. Again cities with similar size, demography, and geographical location can be taken as case-study cities.

7. CONCLUSIONS

The negative result of the urban transformations in the twentieth-century Iran has been shift from humanist urbanism to automobile-oriented planning. These transformations have led the Iranian cities to not only a weak social cohesiveness such as lack of sense of community and place, but also inefficient

physical built environment, which results in unsustainable mobility. Regardless of the social motifs, the urban form is an important factor that pushes the urban dwellers to use personal cars increasingly. Such motifs are theoretically discussed in this paper as the points that should be researched more. Neighborhood-Oriented Planning is suggested as a basic human-based method of planning which has roots in vernacular urbanism. The human-scaled neighborhood with all the traditional specification like area, accessibility, centrality, etc. is reintroduced as a notion that can be reused in the new planning practices. Neighborhood needs to be redefined in the new planning. What is now applied in urban administration and planning is a large area that cannot act like the traditional neighborhoods. This large area may be suitable for administration purposes, but makes problems in social and mobility-related activities. Such problems become more serious when combined with fast urban sprawl and ineffective public transportation.

Nevertheless the suggestion of defining smaller areas as the neighborhoods and neighborhood units with distinct centers should be empirically put to test. Several quantitative, comparative studies are needed to scientifically show the advantages of the neighborhood units in sustainable mobility. The micro-scale and city-scale observation are suggested to strengthen the land use/transportation impact studies among Iranian scholars. Such studies are to show if the small residential units have the capability of focusing and shortening the urban trips towards neighborhood centers. The long-term conclusion will be drawing the attention of the decision makers to the advantages of localization of trips in traffic calming strategies. This approach together with promotion of public transportation can be an alternative for the current look of the urban authorities that attempts to build more urban highways.

This paper suggests combination of two trends combined with each other to produce neighborhood-oriented urban planning that leads to sustainable transportation:

- Strengthening local (neighborhood) centers accessible for pedestrians and bikers.
- Connecting the local centers to one another by efficient public transportation networks.

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