The idea of pedestrian pockets as a key for successful transit-oriented development for Najaf city-Republic of Iraq

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Abstract. The article discussed one of the trends for new urbanism movement, namely transit-oriented development and pedestrian pockets. Two zones were examined within the city of Najaf in the Republic of Iraq, where two pockets were identified within the city were Maidan and the Sadrain squares. Three criteria were identified (land use, density, transport), then the indicators were derived from the criteria and their limits were defined to achieve a sustainable urban form. The analysis process was applied using the GIS environment. According to the results, It has been identified as the most important measures the most positive and negative characteristics of Maidan and the Sadrain squares and recommends the procedures to be carried out for the purpose of developing the two pockets, so as to help stakeholders decisions–making in the development of urban projects.

Introduction

New urbanism movement is an attempt to combine all the advantages of opposing approaches in urban planning: the perception of the city as a system and the perception of the city as a medium. The purpose of New urbanism movement is to create a comfortable urban space that satisfies the needs of citizens in communication while maintaining the function of the city as a system for the effective creation, distribution and multiplication of resources [1]. The application of New urbanism in regional settlement systems planning allows you to optimize the transport frame of the study area [2]. The projects of Transit-oriented development (TOD) represent the most popular and successful projects within the movement of New Urbanism in urban planning. The trends of Transit-oriented development are based on building a community around public transport stations with mix land use development and medium to high density, high accessibility for a different mode of transportation (walking, cycling, public transport…etc.)(3). The clear root of Transit-oriented development trends returned to the idea of Pedestrian Pockets (PP). Pedestrian Pocket was a concept that revealed in the late 1980s, after the debate on the effectiveness of investments on transit transport lines and their role in increasing economic development[4]. The pedestrian pockets put forward by Sim van der Ryn and some architectures that introduced the book of “Sustainable communities” in 1980[5]. Although this work not focused in transit design as much as its emphasis on the encouragement of hierarchy streets, minimizing traffic and the car trips, compact and mixed land use, walkable communities and environmental design[6]. These works occupy the leading position in presented the pedestrian pockets
that introduced through the works of the Peter Calthorpe “The Pedestrian Pocket Book (1989)” that co-authored with Douglas Kelbaugh [7]. The pedestrian pocket can be described an area with mix and compact land use with an estimated area at 12-25 ha, which represents the “walking sheds”, and the main activities can be performed by walking in a period not exceeding 5 minutes or 400 meters[8]. The basic idea of the pedestrian pockets is that reforming of the garden cities and Radburn idea of superblock in order to meet the present and future requirement of the lifestyle. Pedestrian pockets focused on the need to separate the movement of cars and pedestrians, but it is replaced the large open spaces and parks in Radburn by some activities like shops, business and medium and high accommodation which plays a role in adding vitality to urban communities [9]. Peter Calthorpe has inspired this work to provide the most effective work on the movement of New Urbanism tend of transit-oriented development. TOD is the practical implementation version of the pedestrian pockets that developed to providing the detailed information on the density, spatial organization of land use, and types and intensity of density that this article will explain and analyze this modern form of the development within the New Urbanism movement. This article will explain and analyze this modern form of the development within the New Urbanism movement. In order to demonstrate the importance of this trends, criteria and indicators of urban planning design for this type of development will be applied to the city of Najaf in Iraq and measure their efficiency to assist stakeholders in decision-making in urban development projects.[10]

Goal, Tasks, Methods of Study
The goal of this work is to discuss the development of one of the popular and successful trends for the movement of new urbanism which is “Transit-Oriented Development (TOD)” and “pedestrian pockets” that represent the key to the success of any development projects depends on this trend in urban development.

In order to get the goals, this article will including data collection, and build the database for land use by using the environment of Geographical information systems (GIS), then identifying criteria and derivation of the indicators of each criterion that used in the article depending on the characteristics for the urban form of transit-oriented development.

The method that will be used in this article are based on analytical approach within the GIS environment of the indicators derived from the selected criteria and comparing these indicators with the specific criteria for the urban form of the transit-oriented development model and discuss the resulted by the maps and quantitative and descriptive indicators.

Experimental Part
Najaf province is one of the provinces of the Middle Euphrates in the Republic of Iraq and about 160 km from the capital of Iraq Baghdad, and administratively the city of Najaf has represented the administrative center for the province. Najaf city has acquired religious importance to Muslims (Shia) as a result of hosting the shrine of Imam Ali bin Abi Talib. Then, it gained religious and commercial significance for tourists who comes for the purpose of seeking blessing and visit the shrine[11]. The Najaf Sea and the cemetery on the western side had a negative effect for the urban growth and directed the growth of city of Najaf toward the city of Kufa, about 10 km on the east, as well as the existence of the mosque of Kufa, which contributed to making the two cities grow one way towards the other. Maps (1, 2) shows the location and master plan of the province of Najaf and it’s center

Some studies were specialized in the development of specific indicators for pedestrian pockets, while others have developed indicators for the TOD system in general, but many of them lacked the status and classification of indicators within integrated groups based on spatial structure and hierarchies within a sequential form. In this article, It will not be limited to examining the general indicators of the locations of pedestrian pockets but identifying components of the criteria on which to measure the efficiency of the pedestrian pockets and TOD system by the following criteria (transport and movement, densities of pockets, and land use characteristics) then derived each of these criteria by representing a set of measurable indicators.
In this article, the general system of TOD within the public transport axis between Najaf and Kufa cities will be determined by identifying three areas around two nodes, the first one is the Maidan square, while the second one is around Sadrain Square, and then work on the creating of three ranges (400, 600, 1600 meters) around pocket (transport nodes), which will be analyzed on the basis of the planning and design criteria depending on criteria selected (Transport, Land Use, and density).

Figure 2 below shows maps area of analysis and the zone ranges of the selected pedestrian pockets:

**Table 1.** The result of measuring of the density indicators for Maidan and Sadrain pockets

| criteria  | Indicators                        | Limits                                      | Maidan pocket          | Sadrain pocket    |
|-----------|----------------------------------|---------------------------------------------|------------------------|-------------------|
| Density   | The overall density of houses    | The number of houses within the overall area of the p.p. (25-49) | 33 [unit /ha]          | 26 [unit /ha]    |
The overall density of population

| Housing density by type of area within each pocket | Transit core (high) | High | Low |
| --- | --- | --- | --- |
| Transit neighborhood (medium) | Medium | Low |
| Secondary area – separated houses (low) | Medium | medium |

| floor area ratio | coverage of building (60-75%) | 85[%] | 73[%] |
| --- | No. floors (3-7) | 4 | 2 |

| Density of jobs | 100 jobs per hectare | 277 | 189 |

The results for the process of measuring density indicators showed clear differences. The Maidan and Sadrain pockets showed high efficiency in the indicators (overall density of housing and population as well as homogeneity in the distribution of density within the studied area in the Maidan pocket. In contrast, the Sadrain pocket which was outside the standard at this indicator. In terms of floor area ratio indicators outside the standards in indicator for coverage of building and matching in respect of the number of floors in Maidan pocket, and in contrast in the Sadrain pocket, as for the density of the jobs, the results showed the excellent density for jobs structures in both nodes.

**B. Land use:** The provision of an urban form in which a high degree of mixed land uses would integrate between the land uses of residential, commercial and recreation…etc. The combination of land uses includes two patterns where there is a vertical mix at the level of separate buildings which includes residential, commercial and recreation uses, which is often distributed within multiple floors of buildings and a horizontal mix of land use which is often at the level of blocks and neighborhoods[15]. some of indicator was identified and calculated by depending on the standard using the environment of GIS and table 2 shows the results of the calculations:

**Table 2.** The result of measuring of the land use indicators for Maidan and Sadrain pockets

| criteria | Indicators | limits |
| --- | --- | --- |
| Land use diversity | Residential use 30-45[%] | 44 | 41 |
| | residential and commercial use together 10-15[%] | 13 | 3 |
| | Commercial use 5-20[%] | 20 | 18 |
| | Service use 5-15[%] | 4 | 11 |
| | Streets use 25-30[%] | 19 | 27 |
| There is an open area that forms the heart of the pedestrian pocket | Percentage of the overall area 10-20[%] | 8 | 3 |
| Accessibility between uses | A distance of no more than 500 [m] or 5-10 [minutes], | High | Medium |
| Homogeneity and integration of uses | Moving from one use to another such as commercial, residential, and services and avoiding harmful uses such as industrial and polluted uses. | Medium | High |
| Encouraging uses of job creation and employment opportunities | There are commercial and services and administration uses | High | High |
| Providing a suitable mix of housing | Different types of houses | Medium | Low |
The uses are directed to cover all the needs of the communities.

| Land uses supporting different segments, ages, and cultures of society | Medium | High |

The results analysis showed a clear diversity of land use in the Maidan pocket with a severe shortage of services and streets. Sadrain pocket also showed high efficiency in diversity, except for the absence of a mixture between the residential and commercial uses. The lack of sufficient space in the central area in both of Maidan and Sadrain pockets, although it is more obvious in the Maidan pocket, that it needs more spatial organization. The accessibility and supporting of land use for different segments of people varied from high to medium in both pockets. The homogeneity indicator was also good from medium to high, and the housing mix was medium in the Maidan pocket to weak in Sadrain pocket.

C. Transport: One of the dimensions of a sustainable urban form is that it has an integrated transport system that supports all types of transport modes (walking, cycling, public transport, etc.). The transport network must support social interaction and works to reduce the cost and time and effort to perform various activities. Accessibility affects various land use activities and is an important indicator of sustainable urban form. Therefore, providing an urban structure conducive to environmentally friendly movement and encourages a sense of place within the human scale is an important factor in integrating the land uses and the transport network [16]. Table 3 shows the calculation results of the transport indicators for the pockets:

| Criteria | Indicators | limits | Maidan pocket | Sadrain pocket |
|----------|------------|--------|---------------|----------------|
| Transport | Different mode of transport | Walking and cycling (10-20%) | 55 [%] | 17 [%] |
| | | Public transport (7-15%) | 27 [%] | 23 [%] |
| | | The private cars do not exceed (65%) | 18 [%] | 60 [%] |
| | Connectivity between streets | No. of connection nodes 160 node / 1 Km | 211 | 138 |
| | Provide an urban structure supporting the movement | Transport and recreation stations, pathways, afforestation | low | low |
| | Distribution of parking lots and bicycles | the Encouraging distance for environmentally friendly movement (300 m - 400 m) | high | medium |
| | Sense of Place, accessibility to destinations. | human scale, providing shadows for pedestrians, not intersecting with heavy traffic axes for cars | high | medium |

The results of the analysis of transport network showed that there are different modes of transport (walking and cycling) in Maidan pocket because of the high activities for the pedestrian in the area at the expense of private transport, and in contrast, in the Sadrain pocket, while the dependence on public transport in both pockets was close and acceptable. Connectivity level was also in Maidan pocket higher than Sadrain pocket. The supporting of urban structure was weak at both pockets, parking, and sense of place and accessibility to destinations in Maidan pocket are good compared to the Sadrain pocket.

Summary
The results can be summarized based on the analysis of derivative indicators of the criteria for both pockets by many details. It can be concluded that both pockets have shown great potential for development and the possibility of creating typical pedestrian pockets as they include diverse land
uses and activities that encourage pedestrian movement and activate spatial interaction. The indicators related to the density were overall good but needed work to encourage the creating of other types of residential accommodation, especially apartment housing in the Sadrain pocket, especially that the pocket includes land uses that stimulate the emergence of hotels as well as buildings that include a vertical mix of residential and commercial. It is also necessary to work to create urban spaces representing landscape or spaces for social interaction to create a clear and stimulating nucleus to regulate the enclave around them in both pockets, as well as activating the mix of vertical land uses of housing and commercial, and not limited to separate buildings and horizontal mix land use in Sadrain pocket. As well as reduce dependence on private cars through the distribution of activities and services, especially in the Sadrain pocket, as the activities within the node stimulate the movement of the pedestrian in the evening only because of the nature of business activity in it. It is important to support the infrastructure of the pedestrians through clear paths shaded and achieved the human scale and containment as well as seating places, fountains, as the results showed the lack of both pockets.

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Acknowledgments

The work is realized in the framework of the Program of flagship university development on the base of the Belgorod State Technological University named after V.G. Shukhov, using equipment of High Technology Center at BSTU named after V.G. Shukhov.