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**INVESTIGATION INTO STRUCTURE OF PASSAGE NETWORK AND
PERMEABILITY OF WORN- OUT URBAN TEXTURES AND
PROVIDING SOLUTIONS FOR IMPROVING IT
(CASE STUDY: MASHHAD)**

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ABSTRACT

Uncontrolled and unplanned spatial extension of metropolises and medium cities of the country for the past decades has given rise to the formation of new urban textures in proximity to the cities; relocation of the residents; and transfer of urban occupancies to the new areas. As a result, this relocation and transfer began to lose their old urban textures and socio-economic application and life. Having lost their urban life, these textures tended towards the state of recession and being worn-out. The city of Mashhad with an increasing population growth during the recent decades as well as high capacity of immigration has been greatly extended. Winding and narrow passages, insufficient structural integrity of buildings, low area of occupancies, lack of security and safety and etc. all are examples of the most obvious problems easily seen in these areas. Thus, in this research, passage permeability is investigated, and to solve this problem, necessary questionnaire has been made. Among the residents, passers-by and pilgrims, opinion of some experts in this regard has been obtained. Finally, using analytic hierarchy process (AHP), criteria and sub-criteria have been prioritized, and it can be said that the modification of physical problems of this area is deemed the most important criterion or in other words, transportation and traffic problems may be solved by modifying the physical ones. Of the sub-criteria in question, strengthening historical axes, improving performance of public areas, erecting urban railway, geometric correction of passages, increasing quality of buildings, improving public transportation system, encouraging walking, building car parking, improving performance of business space and etc. are a top priority.

Keywords: *Worn-Out Texture, Passage Permeability, Central Texture, Mashhad, Analytic Hierarchy Process (AHP)*

INTRODUCTION

Wear-and-tear is one of the most important problems with respect to urban space, causing disorganization, lack of balance, lack of fitness and deformation (Habibi, 2009). Worn-out urban texture refers to some parts of legal areas of cities which are vulnerable and have low spatial, environmental and economic value, due to physical wear-and-tear, lack of adequate roadway access, utilities, urban services and infrastructure. Such textures, because of their poor occupants and owners, cannot be spontaneously reconstructed, and also, investors lack motivation for them (Ebrahimzadeh, 2012). In 2006, Iranian Supreme Council of Urban Planning and Architecture developed its indices of identifying worn-out textures, as follows:

1. Fineness: Those blocks with more than 50% of units measuring less than 200 sq.m;
2. Instability: Those blocks with more than 50% of instable buildings lacking structural system;
3. Impermeability: Those blocks with more than 50% of passages less than 6 meter wide (urban planning and architecture regulations and development projects approved by Iranian Supreme Council of Urban Planning and Architecture, 2009).

Communication network of cities is composed of rapid communication network which is non-local and delicate arteries of access network in which there is origin and destination of traffic and is local (Gharib, 2010). The structure of communication network is considered either as primary or underlying factor of formation, or as secondary factor of formation, or, often accompanied by urban uses, constitute

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determinant factors in making main structure of a city appeared. As a result, identifying the structure of communication network is not acceptable only in terms of traffic and transportation standards but also more important factors affect its appearance (Abbaszadegan, 2011).

MATERIALS AND METHODS

Methods

Methodology of research is of qualitative type and, by nature, of descriptive-analytic one; that is, in addition to understanding and imaging, the nature and features of phenomenon, because of phenomenon appearance and its status, are described using logical reasoning based on related theoretical propositions.

Information Collection Method

Information is documentarily collected through reading set of reliable scientific-research papers; research propositions including master's theses, Ph.D. dissertations; reading scientific books in connection with the subject of research; as well as studying approved documents and evidence available at the records of Roads and Urban Development Department, such as city plan of Mashhad; master (detailed) plan of Mashhad; and informal settlement organization plan in Mashhad metropolis.

Information collection includes library information and field information collection and presence of the author in worn-out textures of Mashhad as well.

Information Analysis Tools

Collection of library studies by means of note taking on index cards in theoretical, and by means of distributing and collecting questionnaires among occupants and residents of worn-out textures, in practical. Nonrandom sampling will be made using random method, interview with occupants and authorities of the organization concerned, the author's observations on worn-out textures of the city, use of satellite (Google Earth) maps and geographic information system (GIS).

Information Analysis Method

Spatial information analysis in this study is made by GIS software with the aid of Analysis Tools. Analysis of questionnaires' information will be carried out by Excel and SPSS software. Also, obtained data analysis and prioritizing wear-and-tear affecting inefficiency of passage network will be made by means of analytic hierarchy process (AHP) method and Expert Choice software.

Case Study

Mashhad is the second populous city of Iran after its capital, Tehran.



Figure 1: Land use of the study area

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Mashhad includes 13 municipal districts one of which measuring 360 hectares includes 4 segments known as worn-out textures around pilgrimage area of the Holy Shrine of Imam Reza (PBUH), where the main core of Mashhad exists. Mashhad is a city having a population of 3 million. About two third of Mashhad's population reside in informal settlements and worn-out texture. The population of the study area in 2006 amounted to 32330 persons of which 15707 formed about 49% female and 16623 about 51% male of this area's population. Economically, in 2006 of the entire population of the study area, 9848 people (about 30%) are considered economically active, of which 1159 (about 12%) are females and 8689 (about 88%) are males. Physically, physical texture around the Holy Shrine is worn out and inefficient. Business use mostly is seen at the edge of main streets and even subsidiary streets of the study area. Per capita tourism and reception usage is very low in comparison with estimated city plan. About 45 percent of religious usages exist at the study area. There is an unbalanced distribution of per capita streets and passages at the study area.

Areas of Occupancies around the Holy Shine

At the study area, of 13147 properties, 9777 ones have a size less than 200 square meter. In other words, about 75 percent of the properties have an area less than 200 sq.m.

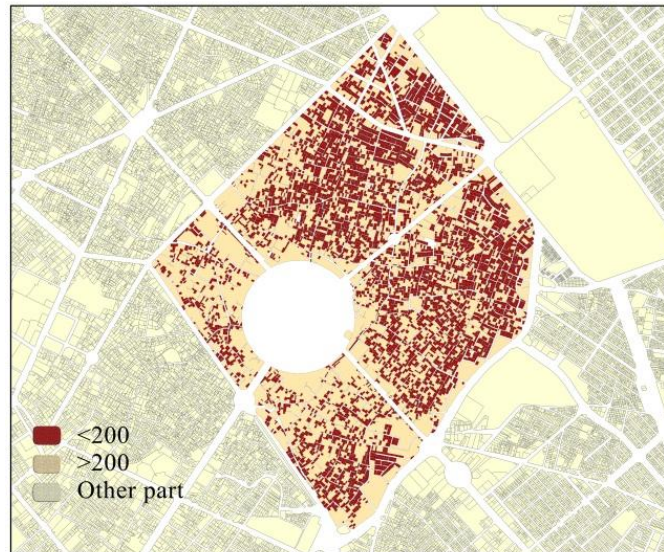


Figure 2: Areas of Occupancies around the Holy Shine

Studies on Transportation Traffic

Passage (street) network in old parts of the city have an organic texture (specific for pedestrians) and one of the factors causing malfunction of arterial passages is the erection of business uses at their edge. More than 77% of commutes inside the city of Mashhad are made bound for the downtown. 55% of commutes attracted to the downtown are made in order for reaching workplace (60% of the commutes are made by passenger car and 10% by bus) and about one half (47%) of the vehicles entered the downtown of Mashhad, plan to not stop at the area and most of the streets of the downtown are fully saturated at the times when traffic reaches its peak (Plan for Renovation and Reconstruction of Texture around the Holy Shrine of Imam Reza (PBUH), Tash Consulting Engineers, 2004).

Because of concentration of the city's hotels located at this area and their proximity to the Holy Shrine, most of the pilgrims residing at the area travel on foot. This is why volume of foot traffic in this area is very high (Plan for Renovation and Reconstruction of Texture around the Holy Shrine of Imam Reza (PBUH), Tash Consulting Engineers, 1994). Given unsuitable nature of the passages inside the area for car traffic in four streets led up to the Holy Shrine, while providing the possibility of access to the Holy Shrine, they play the role of a communicating artery for other parts of the city as well. In fact,

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transmission congestion is heavy on the shoulders of these streets (Plan for Renovation and Reconstruction of Texture around the Holy Shrine of Imam Reza (PBUH), Tash Consulting Engineers, 2004).

Impermeability of the Street at the Study Area

Main streets led up to the Holy Shrine include Ayatollah Shirazi Street of 45 meter wide, Tabarsi Street of 18 meter, Navvab Safavi Street of 30 meter, and Imam Reza Street of 45 meter wide. In general, the streets led up to the Holy Shrine have high width. On the other hand, 90% of the passages inside the texture have a width equal to and less than 6 meter. The following drawing shows properly the streets at the study area. Concentration of business use at the area around the Holy Shrine increases traffic volume at this area, on one hand, and on the other hand, due to lack of sufficient space for clients and employees' car parking, occupies street surfaces by those vehicles parked at the edge of streets and, as a result, decreases traffic flowing in them (Plan for Renovation and Reconstruction of Texture around the Holy Shrine of Imam Reza (PBUH), Tash Consulting Engineers, 1994).

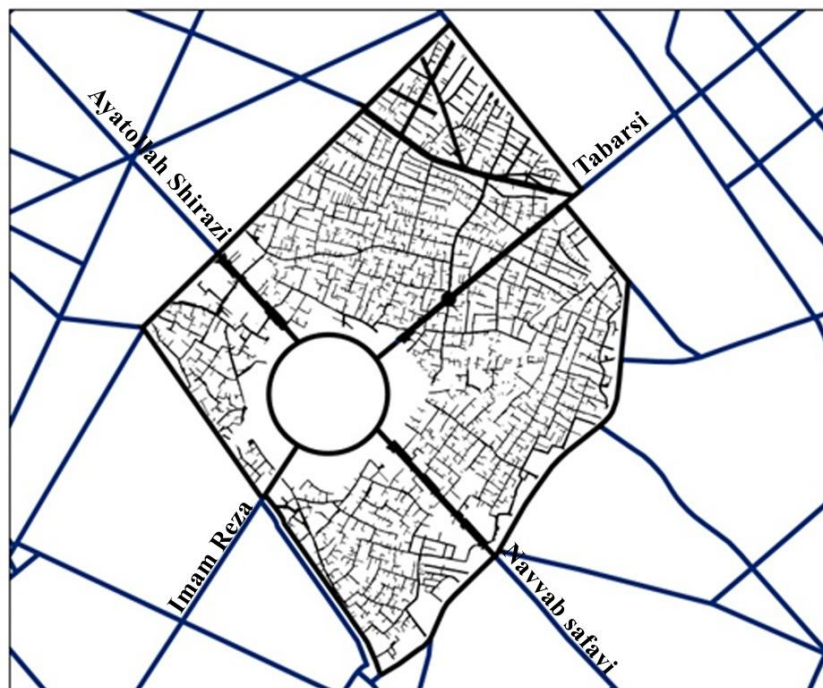


Figure 3: Impermeability of the street at the study area

Questionnaire

The population of the study area in 2006 was about 32330 persons. From the population of the study area, we reached 379 samples, given method of statistical sampling based on Cochran method with error level of 0.5%. In general, filling out the questionnaire of the results indicates that street status in terms of access, safety, vitality etc. lacks any utility for use and improved function of the streets is contingent upon widening of streets and change in their performance.

Determining Criterion and Sub-Criterion

To achieve the goal of the research, we require drawing hierarchical structure of AHP. Given Delphi method, we embarked on collecting opinions of experts at the headquarters of worn-out texture of Mashhad, that of Deputy Mayor for Architecture and Urban Planning of Mashhad Municipality, and that of experts of Samen municipal district. Combining such opinions with the analysis of replies of occupants, pilgrims and passers-by at the study area to questions of the questionnaire resulted in the following tree structure:

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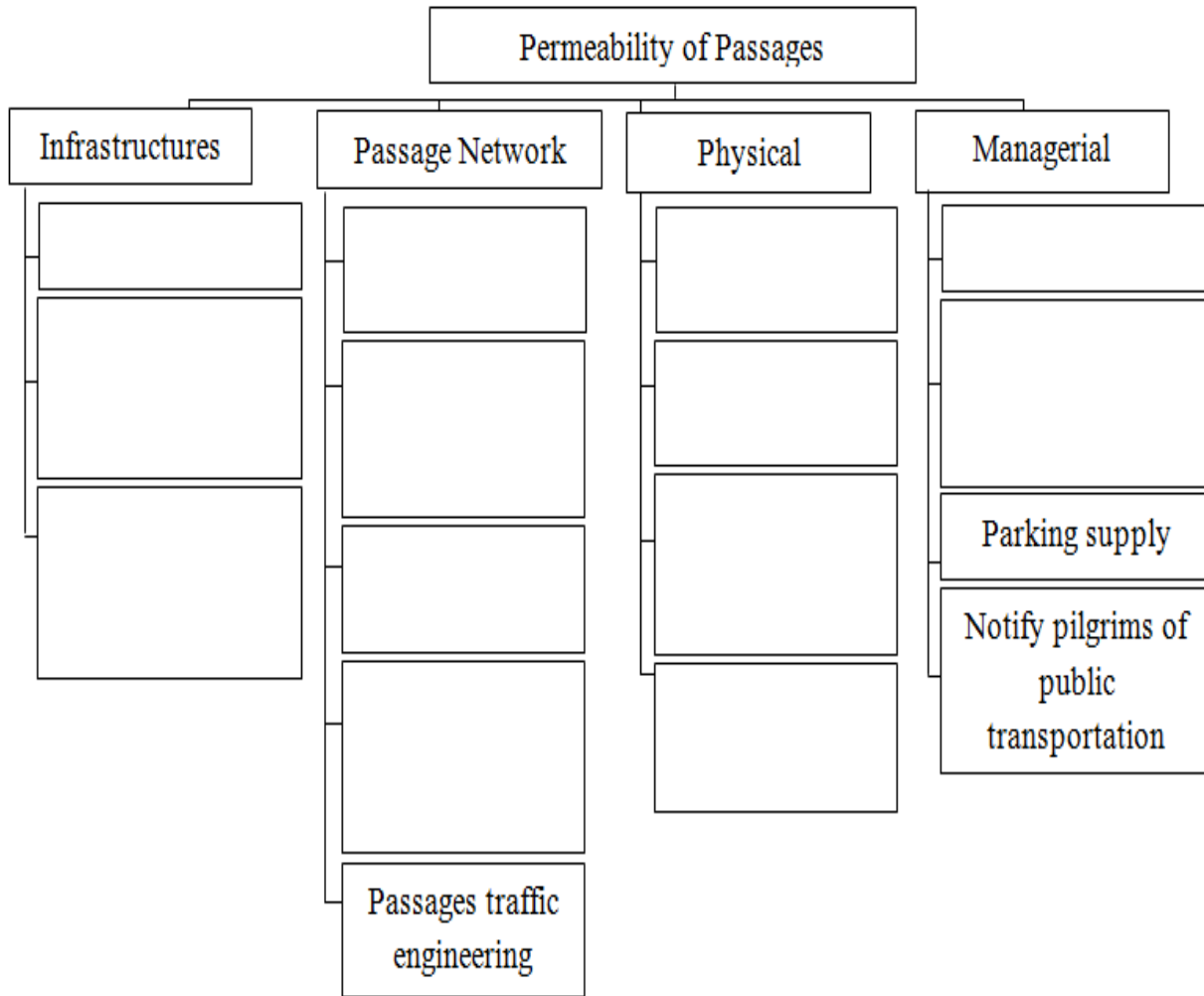


Diagram 1: Analytic Hierarchical Process (AHP)

AHP Analysis

Networks were prioritized in order. When prioritizing criteria and sub-criteria, adjustment has been taken into account. Adjustment less than 0.1 is acceptable. In such prioritizing, adjustment is 0.07. Weighing table and related diagram are as follows:



Diagram 2: Prioritizing Criteria

After weighing and prioritizing criteria, it is time to weigh and prioritize sub-criteria. After weighing, sub-criteria are prioritized as follows:

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Synthesis with respect to: Goal: Permeability of Passages

Overall Inconsistency= .07

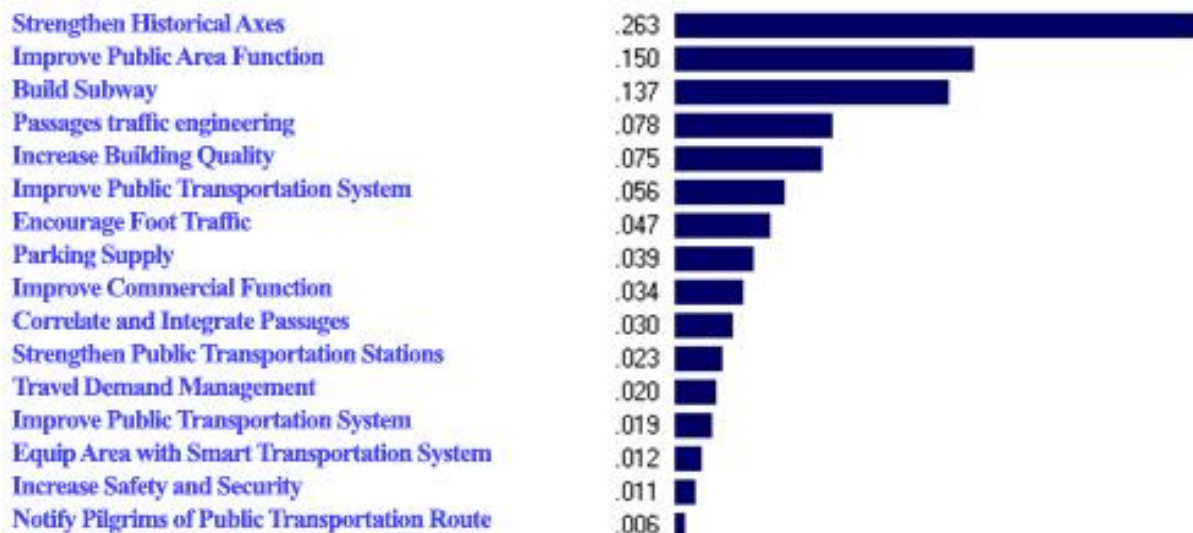


Diagram 3: Prioritizing Sub-Criteria

After prioritizing sub-criteria, strengthening historical axes, improving function of public areas, building subway, geometrical modifying passage and streets, increasing building quality, improving public transportation system, encouraging foot traffic, supplying car parking, improving function of business space etc. are top priorities.

RESULTS AND DISCUSSION

Worn-out urban textures which, at one time, had been principal source of social, economic, cultural and political developments in our country's cities, constitute the main problem in urban management process for physically organizing cities, due to non-matching aspects of developed life in modern cities.

In the present study, according to occupants and pilgrims, municipal actions are ahead very slowly. Despite of the lapse of many years, property ownership has not been completed yet and shows a slow process. Some of the main streets have been widened. Lack of functional hierarchy has created some traffic problems. On the other hand, uncontrolled development and construction activities at this area also have caused some chaos for the area.

Prioritizing sub-criteria one after the other include strengthening historical axes, improving function of public areas, building subway, geometrical modifying passage and streets, increasing building quality, improving public transportation system, encouraging foot traffic, supplying car parking, improving function of business space etc. So, the following strategies are offered for improving street status:

- Strengthen historical axes and promote their functions through introducing historical centers to pilgrims and neighbors;
- Strengthen historical axes and correlate axes by encouraging foot traffic;
- Strengthen public areas;
- Hold religious ceremonies and ... in public areas;
- Strengthen public transportation including subway, bus and taxi;
- Geometrically modify streets and passages;
- Correctly connect two textures and prevent central texture from isolation;
- Suitably define intersections according to their capacities;
- Physically promote the buildings at the study area through partnership, investor attraction methods etc.

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- Geometrically modify organic streets of the area and use their principal bed;
- Amend hierarchical system of passages inside texture;
- Widen dead alleys; set their width to length ratio;
- Special attention to designing and correlating passages;
- Correct passage network through defining a suitable cross section while taking account of fringe parking, temporal parking and loading platform for uses;
- Unique design and prolong the time for failure to enter car traffic;
- Appropriately define principal places in which car traffic and foot traffic intervene.
- Define special traffic rules and regulations for this area;
- Design spaces with the capability of foot traffic according to low vehicle ownership per capita;
- Control parking space;
- Erect car parking;
- Encourage to integrate properties and build big trading centers;
- Establish appropriate relationship between intra-neighbor network and public transportation stations;
- Equip the area with public transportation system;
- Improve public transportation system and use environmentally friendly solar-powered buses;
- Equip the area with smart traffic systems and enforce punitive regulations towards controlling traffic;
- Timetable public transportation vehicles;
- Notify occupants and pilgrims in detail of public transportation vehicle timetable.

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