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The Spatial Analysis of Hot Spots in Urban Areas of Iran. The Case Study: Yazd

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Abstract

The 20th century can be characterized by its urban population density, urban *geographical* stratification by *socio-economic status* and urban crime increase. Concerning the importance of prevention in social planning, policies and planning concentrate on crime prevention and emphasize the backgrounds and contexts leading to crimes. The present study aims to analyze the crime hot spots of Yazd and to suggest effective solutions to reduce crimes occurrences. The present study is a cross-sectional descriptive study. Data was collected by studying offenders' files, achieved in the Yazd Police Office, in different districts of Yazd between 2008 and 2010. The results revealed that the mean center of all kinds of crimes is in city center. The nearest neighbor index for drug crimes distribution had a full cluster distribution. The correlation coefficient confirmed the relationship between population density and committing the crimes. The results revealed that most of the crimes were committed in abandoned, residential, street networks and commercial land uses, while in religious and cultural land use less crime occurred. There were significant correlation between population density, different urban land uses and the rate of crime. The rate of crime in abandoned and populated areas was more than other areas.

Keywords: crime analysis; spatial crime distribution; urban design; hotspot analysis; population density.

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Introduction

The crime spatial distribution pattern based on land uses is one of the demographic characteristics which effect the development of a hot spot. This issue, which is one of the topics of urban geographical studies in recent decades, provides the framework for spatial analysis of crime and the study of the relationship between social misbehaviors and time and place in an urban area. Spatial image of crime distribution and comparing its data with characteristics of the place of crime, socioeconomic status and location of the offenders give us the opportunity to identify the crime hot spots and to predict the possible crime places in urban areas. In sum, the collected data can be useful in reduction and prevention of crime in urban areas and leads to higher security (Canter, 1998; Kalantari, 2001). Marginalization is a developing problem in cities, according to global observations. Due to lack of access to appropriate equipment, facilities, and education, marginalized people are not able to find a worthwhile job and to earn sufficient income (Epel, Kaplan, & Moran, 2010; Hossein Zadehdalir.K, 1991). Since the legal means of success are out of reach, they may try illegal ways (Doroodian.A, 1992). As a result, social misbehaviors increasingly develop in marginalized areas and crimes such as theft, liaison, smuggling, etc. increase (Farjad, 1991; Doroodian, 1992).

Due to quick growth of urbanization, Marginalization has developed in old and abandoned areas and their neighbors, in Yazd. Life standards in these areas are significantly lower than other districts. Factors such as unemployment, poverty, not standard ramshackle houses, social isolation, and detachment from common social values, lead to social misbehaviors and urban social threat in those areas (Oloumi, 2004). The present study attempts to identify geographical distribution of social threat in Yazd districts. Analyzing the relationship between marginalization and social urban threat, this paper investigates the influential factors. The main hypotheses of this study are as follows: (1) populated urban areas are the main crime hot spots; (2) crime hot spots are correlated with inappropriate land uses and design and less possibility of control.

Theoretical framework

The early scientific studies on geography of crimes in urban areas began in the first half of 19th century based on theories of social ecology and were continued by scholars of Chicago Ecological School in the early20th century (Beirne, 1986; Wong, 2012). However, in recent decades, particularly after 1990, while there were quick growth of urbanization and exponential increase in crimes, scholars focused on the geographical study of urban crimes which leads to the development of spatial analysis instruments and introduction of new theories and approaches

on this issue. Study of crimes is one important part of urban ecology (Wong, 2012). In ecological perspective, people in urban community tend to reside in the neighborhood of those who are of similar social status. Thus, urban areas become distinct. Therefore, urban community consists of different and complex social zones (Smith, 1973). Reputation of Burgess is mostly for his studies on urban spatial structure which divide the city in zones radiated from city center and moved concentrically outward (Burgess, 1967). “Sylvie Rimber” the concentric zone model proposed by “Burgess” is completely sociological and his urban zoning system was based on the importance of ethnic groups. In this zoning system, other factors, for example economic view was also taken into account because by moving toward outer zones, access to facilities decrease and consequently the land price go down (Farid.Y, 2001).

In marginalized areas, using transportation services to get to and from work, shopping, etc. takes more time and money and causes fatigue, therefore the land price is lower. As a result, people with low-income move towards the suburbs and urban margins. There is an exception when central part of the city is old, with inappropriate environmental conditions, therefore, the poor resides in these cheap lands and resigns themselves to daily mobility (Farjad, 1991). “Theo Mobardelo”, unlike “Rimber” believes that “Burgess” zoning system was not only based on economical level and social status, and demographic process, population density and mobility, technical and economical processes and historical factors affect the concentric zoning of urban areas. Crime and organized environment is observable and controllable, therefore dwellers’ usual supervisions may prevent crimes (Jacobs, 1961). Crime opportunity approach considers characteristics of urban space as an influential factor in criminal acts and proposed some ideas which urban designers can use to build crime-preventing spaces (Kalantari & Tavakolli, 2007). Crime opportunity theory suggest that for committing a crime only the presence of an offender and a victim is not sufficient and favorable environment and situation is also required (Kalantari, 2008). Other studies also introduced the dirty, unorganized, and messy structure and design of buildings and neighborhoods as an influential factor in crimes and social deviance (Wilson, 2003). Studying the basis of crime opportunity theory we may refer to the routine activity approach, the rational choice perspective, and crime pattern theory (NajafiabrandAbadi, 2004).

The routine activity approach assumed that for crimes to occur there must be a convergence in time and space of three minimal elements: a likely offender, a suitable target, and the absence of a capable guardian against crime. Several scholars found that some land uses greatly affect the formation of crime hot spots (Sherman, Gartin, & Buerger, 1989) confirmed that there is correlation between the land uses and crime hot spots formation. There is a significant positive correlation between crime rate and the number of bars in several urban districts. They found that this correlation increase when bars are located in unknown parts

of city and the absence of police guardian (Anselin, Cohen, Cook, Gorr, & Tita, 2000). Some other scholars believe that spatial disorders and lack of social solidarity are the main causes of the formation of crime hot spots. Physical features of neighborhoods like graffiti, broken windows, trash and litter, stripped cars, or abandoned buildings, and social cues in an environment like quarrels, harassment, assaults, beggars or homeless persons, raucous groups of young people and drug sellers or users leads to less security and consequently encourage people to commit crimes in these areas (Skogan, 1995). The concept of crime hot spot was introduced by Sherman, Gartin and Buerger (1969) and was used in their spatial analysis of crime. This concept refers to a place or geographical area in which the rate of crime is high. This place can be as wide as a town, a neighborhood, several streets and even a house of a building block. Time analysis is based on kinds and numbers of crimes occurred over time, by discovering the changes and relationship between urban crime occurrences and different months, weeks, days or even hours (Kalantari & Tavakolli, 2007). The present study was conducted based on principles and frameworks of crime hot spot approach and crime opportunity theory for a geographical analysis of kind and number of crimes and its correlation with differences and spatial characteristics of Yazd, cause by complex social, economic, cultural and design factors of this city.

Methodology

This study was conducted as a quantitative cross-sectional research. Location of study was different districts of Yazd. Data was collected by studying 137 files on offenders who committed crimes in different districts of Yazd between 2008 and 2010. The files included information about the kind of crime, place of crime, offender's age, occupation, education, location, and birth place which was used in this paper. To identify crime hot spots, among different statistical methods, mean center, standard deviational ellipse, and clustering test (nearest neighbor index) were used to describe patterns and spatial properties of crime of districts. To operate statistical and graphical analysis, Geographical Information System Software and Crime Analysis plug-in in ArcGIS were used.

Findings

According to the 2006 Iranian population census, population of Yazd was 432194 and its average annual growth rate was 2.8. Immigrants to Yazd between 1996 and 2006 were 77468, most of which belonged to age groups of 20-24 (23.5%) and 25-29 (16.7) years old (Statistical Center of Iran, 2006). Frequency of crime occurrences in different districts of Yazd between 2008 and 2010 showed that smuggling was the most frequent crime in Yazd.

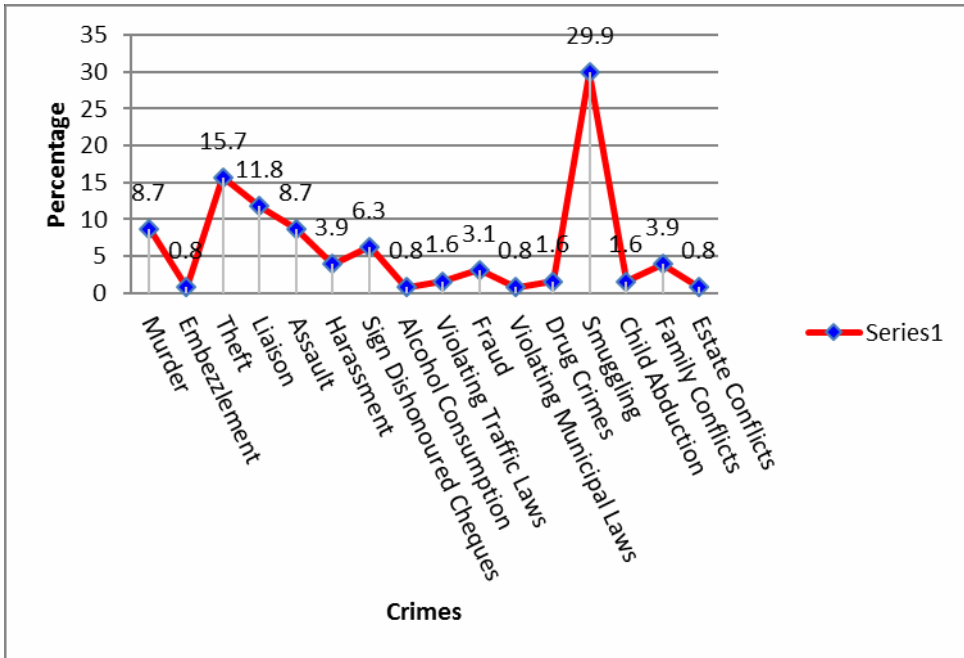
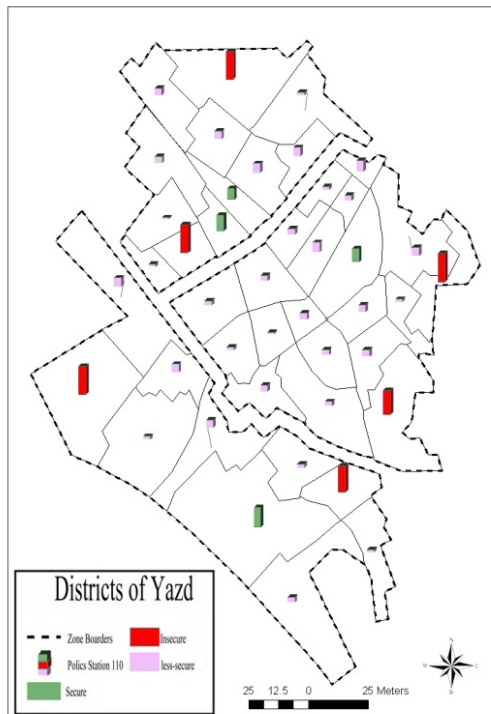


Figure 1. The percentage of different crimes in Yazd urban areas

67.3 % of crimes were committed by male and 32.7% by female offenders. The age range of offenders under investigation was 14 to 65 years old. The youngest group of offenders was 14-24 years olds (17.9 % of all offenders). The number of young offenders indicates the inappropriate condition in Yazd. Concerning offenders' place of birth, it was revealed that 54.03 % of them were born in Yazd and 45.97 % were born in other cities and provinces. The collected data revealed that 73 offenders (58.8 %) were employed or worked somewhere before committing crimes and arrested. 23.3 % of the sample population were unemployed. Analyzing occupational status revealed that rate of industrial employment in Yazd is high. It can be said that Yazd is one of the main industrial zones in Iran and industry sector in this city is able to produce many jobs. The most densely populated districts in Yazd are district 1 and 4 in zone II, respectively with 73.6 and 53.8 people per hectare and the least densely populated areas are Shahediyyeh district and district 2 in zone III, respectively with 7.7 and 21.5 people per hectare. It shows that city center and its neighbors are relatively more densely populated (Consulting Engineers in Field, 2006). Average number of people per household in Yazd was 3.47; however, this rate is different in various districts based on social characteristics of the residents. In EmamShar district there were 4.1 and 4.2 people per household, and in Koshtargah neighborhood the rate was 4.5 people per household which showed that workers and low-income citizens, living in

these districts, had the largest families. Concerning crime distribution pattern, it was shown that moving from city center to the margins of the city, crime occurrences increased and the highest crime rate belongs to the north and southwest of the city, respectively. Concerning offenders' location, it was found that most of the offenders (13.4 %) lived in MahdiAbad district and the least number of offenders (0.8%) lived in AkranAbad, ChaharMenar, Biyuk Avenue, Khoramshad, Ya-ghoubi, and Mullabashi districts. The highest crime rate in MahdiAbad district belongs to female offenders and the common crime among them was smuggling. It is noticeable that none of them were Yazd residents.



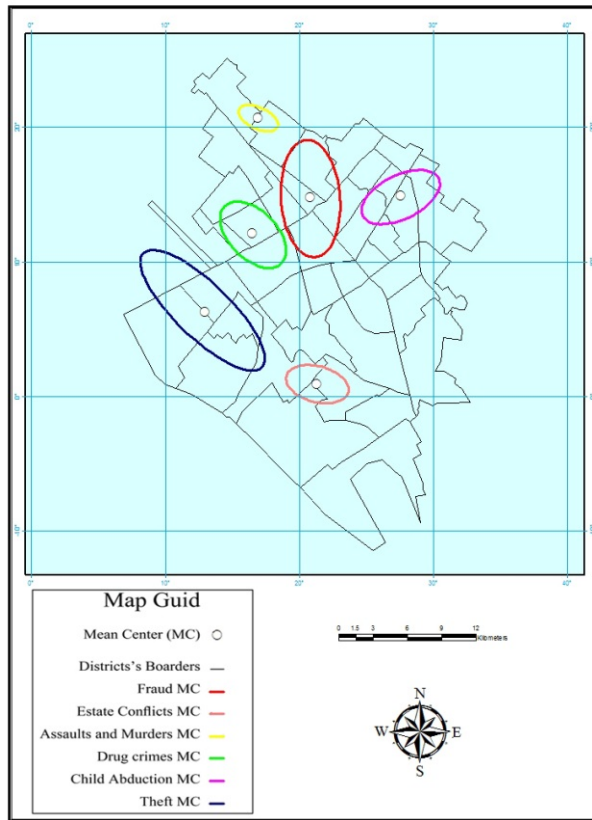
Map 1. Crime Occurrences in Yazd Districts

He mean center point can be used as a relative criterion to compare crimes spatial distribution. The mean center and standard deviational ellipse in *Map 2* shows the crime place in urban districts. The mean center of all of the crimes is the city center. It seems to be the result of having crime hotspots in north and south of Imam Street, Shahriveh the 17th Street and Jomhoury Boulevard which are located in city center. The mean center of all crimes had a tendency toward southwest-northeast, apparently due to the location of two crime hot spots: Azad-Shahr and AmirAbad. One of the main reasons in crime mean center's tendency

toward the north is the presence of old parts of the city, narrow streets, dark empty parks as an favorable crime environment.

To analyze levels of drug crime distribution in Yazd, standard deviational ellipse method was used. In this method, size and shape of the ellipse indicates the crime distribution and its direction shows the direction of crimes. The minor differences among ellipses are due to relative differences in crime distribution patterns. Concerning levels of crime place distribution in standard deviational ellipses' map, we can conclude following points: the smallest standard deviational ellipse belongs to assaults and murders which have the lowest dispersion among different types of crimes in Yazd. It seems that the existence of special places makes the ellipse to be small. The direction of standard deviational ellipses of most of the crimes in Yazd districts are north-to-south and there are tendency toward northeast and southwest which is in accordance with crime hot spots located in AmirAbad, AzadShahr, and MahdiAbad districts. The direction of standard deviational ellipse of drug crimes, comparing to other crimes, has a slight tendency toward southeast and northwest and east. There are several roads entering and leaving the city in southwest (Taft Ravine) and southeast (Mehriz-Ravine) which affect the direction of ellipse of drug smuggling. As it is shown in map (2), Yazd-Kerman road which enters the city from Abuzar Square in southeast and crosses ShahidDashti Boulevard, NajafAbad district, Beheshti suburb and Darvazeh Quran as the leaving point in the northwest, caused formation of many crime hot spots along the road especially in entrance point (Abuzar Square) and leaving point (Darvazeh Quran). Another main city entrance is Yazd-Shiraz road (Taft Ravine) in southwest where there were reported many arrests. One of the main transportation elements of Yazd is the train station located in south of Yazd.

One of the best statistical analyses for determining urban crime hot spots is clustering analysis. There are for several methods clustering analysis of crime distribution. Nearest Neighbor Index is one of them. The nearest neighbor index of drug crimes distribution is 0.068. If the result of nearest neighbor index equals one it shows that crime data are distributed randomly and if it is less than one, it shows that crime data is distributed as a cluster, and if it is more than one it shows that crime data are evenly distributed.

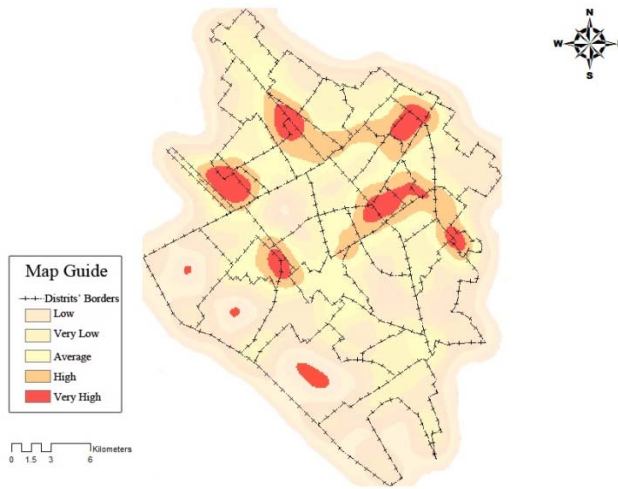


Map 2. Mean Centers and Standard Deviational Ellipses of Different Crimes in Yazd Districts

Table 1. Clustering Analysis and Nearest Neighbor Index of different Crimes in Yazd

Kinds of Crime	Z Score	Nearest Neighbor Index	Spatial Distribution of Crimes
Murder	0.22	-15.14	Cluster
Assaults	1	-42.85	Random
Liaison	0.45	-26.13	Cluster
Embezzlement	1	-32.35	Random
Theft	1.19	-29.74	Even
Harassment	1.12	-49.84	Even
Sign Dishonored Cheques	1	-6.26	Random
Alcohol Consumption	1.21	-21.33	Even
Violating Traffic Laws	1	-7.11	Random
Fraud	1.33	-1.6	Even
Violating Municipal Laws	1	-8.9	Random
Addiction	0.13	-15.42	Cluster
Smuggling	0.068	-1.52	Cluster
Child Abduction	0.84	-25.14	Cluster
Family Conflicts	1	-30.22	Random
Estate Conflicts	1.35	-5.16	Even

Kernel density estimation is one of the appropriate methods for depicting crime data in a surface. According to the map of crime hot spots determined by Kernel density estimation, crime occurrences in EmamShahr, SeyyedSahra, Jahan-Far, Yaghoobi, and Mojahedin are more than other areas. Green spaces (as a hidden place for criminal acts), abandoned landuse, and population density in these districts formed a favorable crime environment. The ranges of crimes, regarding the center of hot spots are shown by red color. AzadShahr and Kheyir-Abad crime hot spots were identified by Kernel density estimation analysis which is shown in the following map.



Map 3. *Kernel Density Estimation of Crime Occurrence in Yazd Districts*

In general, crime occurrences are relatively high around squares located in southeast and southwest and northeast of Yazd such as Atlasi Square, Homafar Square, AmirKabir Square, Kasnaiyyeh Martyrs Square, Amir Chakhmagh Square, and ShahidBeheshti Square. It worth mentioning that crime occurrences were also reported in entrance roads and ravines where there were police stations. It shows the importance of entrance roads and ravines which should be under more control. For instance, drug smuggling in Yazd-Kerman road (Mehriz Ravine) and Yazd-Shiraz road (Taft Ravine) were reported. The main places of drug crimes were the Big Park of the City, Najj Park, Azadegan Park, Tir the 7th Park. In these places, most of crimes, e.g. drug selling and buying in WCs, were reported. The mean center of all of the crimes was the city center. It seems to be the result of having crime hotspots in north and south of Imam Street, Shahr river the 17th Street and Jomhuri Boulevard which are located in city center.

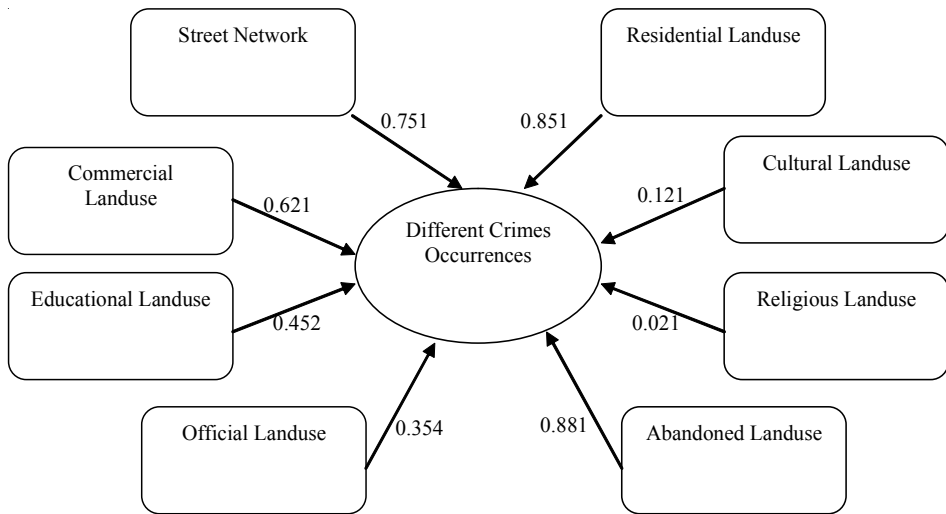


Figure 2. Analyzing the Crime Occurrences Direction in Different Land uses of Yazd Districts

Frequency of crime occurrences in different land uses suggested that residential, abandoned, and street network land uses had the higher crime rate. Direction analysis showed that abandoned, residential, street network and commercial land uses have the highest crime rate and religious and cultural land uses (respectively 0.021 and 0.121) have the lowest crime rate. Therefore, types of land uses in Yazd districts have great effects on formation and spatial distribution of crime hot spots and kinds of crimes occurred.

Discussion

The current study aimed to use theories and principles of crime hot spot approach in geographical analysis, kind and rate of crimes and their relationship with spatial differences and characteristics of Yazd, cause by complex social, economic, cultural and design factors of this city. To do that, urban ecology theories, crime opportunity and favorable crime environment theories were used. To test the hypothesis which said crime hot spots are more in densely populated urban areas with inappropriate design and less control, firstly characteristics of hot spots were studied. The following are the natural characteristics of the most densely populated districts: small residential buildings, using cheap and low quality construction materials in buildings, violation of architectural technical standards in constructions, unsuitable garbage collection, narrow avenues and

alleys in old districts, the high population concerning people per household and per room and the high density of population in these districts.

Studies revealed that EmamShahr, AzadShahr, Atashkadeh old areas, and Fahhadan districts have the highest crime rate. Their design structure is also inappropriate. These explanations are confirmed in several other studies (Akpinar & Usul, 2004b; Kumar & Chandrasekar, 2011) which had shown the effects of types of residential buildings and characteristics of poorer districts on crime occurrences.

The next hypothesis was about the effects of types of land uses of Yazd districts on formation and spatial distribution of crime hot spots. Types of land uses and their distribution in Yazd showed that 32.2 % of the areas have residential land use. Building density in Yazd is 73% in average. Zone II has the highest density (76%) and zones III and I have the lowest density (75% and 68%, respectively). Arid lands have 22.5 % and street networks have 35.4 % of the city's land. Square and cultural land uses have the smallest area in the city (1.3% and 2.6%). Residential land use covers 18% of urban area and have the highest crime rate in drug crimes and alcohol consumption (25.3%). Abandoned land use, covering 26.5% of the urban area, have the highest rate of child abduction and theft. Street networks, 17.6 % of the urban area, have the highest rate of violation of traffic laws (16.6%). Direction analysis shows that abandoned, residential, street network and commercial land uses have the highest crime rate and religious and cultural land uses (respectively 0.021 and 0.121) have the lowest crime rate (Tabangin, Flores, & Emperador, 2008). Therefore, types of land uses in Yazd districts have great effects on formation and spatial distribution of crime hot spots and kinds of crimes occurred. This explanation is also in accordance with several other similar researches (Akpinar & Usul, 2004a; Kumar & Chandrasekar, 2011) in which street networks, commercial, official and residential land uses have the highest crime rates. Barani (2010) found that there is a correlation between land use and crime occurrences in Tehran, however, the highest crime rates belonged to commercial and official land uses. Goodarzi, Abbasi & Asgari (2011) also confirmed the correlation between land use and crime occurrences in Qazvin, while the highest crime rates belonged to disordered land uses of city center, residential, official and commercial land uses.

Conclusion

According to similar studies in different cities of Iran, similar urban characteristics are observable. By the way, cultural, historical, social, and geographical characteristics of urban areas, which are different from one city to another, are an important factor in analyzing crime hot spots, which makes the results as ungeneralizable. One of the unique characteristics of Yazd is its industrial de-

velopments and higher rate of employment which affect the kinds, rates and places of crimes. Regarding the fact that less educational, recreational, and cultural spaces are located in hot-spots, to prevent and reduce crime occurrences, it is necessary to accept some important principles: cultural-educational strategies to prevent crimes which are possible by training, information, development of alternative activities, supporting possible victims, conducting applied research, and using NGOs' help. Hence, it seems necessary to use strategies for increasing social trust among people and public or private organizations focusing on crime prevention. Our findings showed the relationship between population density and crime commitments. Therefore, municipal authorities are to consider constructions organizing, social and welfare development policies in hot spots. Spatial pathology of crime hot spots or possible crime places may help to prevent crime. To exemplify such places, we may refer to areas far from urban nodes, green spaces and parks which create some hidden places, abandoned buildings and areas, dark places in night, large and vast lands, open spaces, places with changing land use. To remove the disorders and tumbledown appearance, such as dirty alley ad ruined buildings, attract offenders and crimes, which leads vulnerability of the people live there. However, this appearance may show that the residents have no tendency to fight against crimes. Controlling parks and entrance and leaving points, equipping police stations with Geographical Information Systems (GIS) and Spatial Data Corpus may reduce crimes occurrences.

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