J. Mater. Environ. Sci. 6 (10) (2015) 2825-2835 *Hosseini et al.*
ISSN : 2028-2508
CODEN: JMESCN

Locating Sites for Temporary Accommodation and Food Storage Silos In The Event of a Crisis in Rasht City-Iran *

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Abstract
Locating functional spaces for the construction of places of relief, silos to store food and accommodation to relieve people's suffering people at times of disaster the key issues in the prevention of crisis management planning and pre-measured intellectual is a disaster. The purpose of this paper is to develop measures to locate, offer essential areas of crisis planning and design of facilities needed in a real incident. The purpose of this paper is to develop measures to locate, offer essential areas of crisis planning and design of facilities needed in a real incident. The findings suggest that the use of existing facilities in good condition there and in the event of a real disaster, many people lack basic amenities and consequently, resulting in pressure on crisis management and a lack of proper accountability them. By overlapping layers of the hierarchical and overall Agency, a total of 11 sites were identified of which the five most critical points and priorities for construction sites and disaster was proposed.

*Keywords***:** crisis prevention, prediction of accommodation sites, locate the key areas in crisis, Rasht

1. Introduction and Problem Statement
Preparation of the urban poor in the face of natural disasters, the lack of places of temporary accommodation, and per capita food storage silos and required levels in the event of accidents are the main challenges faced by the urban management. In this context, the role of prevention and measures to mitigate the effects and consequences of natural disasters pre-measured is important. According to Iran is in the direction of the Alps-Himalaya orogenic belt and having a changing climate and temporary instability and cross has experienced natural disasters, particularly earthquakes, floods and fires in more cities throughout history. According to statistics provided by the 40 types of natural disasters occurred in the world that 31 cases occur in Iran. The existence of such natural disasters in the country led that Iran be among the first of the ten countries in the world in disaster-prone areas [1]. This is factor for more efforts to achieve practical to methods and coherent strategies to deal logically to minimize tragic dimensions such events.
Hence ten days after the tragic earthquake in Bam in an emergency meeting of the crisis management campaign in Tehran on 5 January 2004, the original plan to create support bases for crisis management in Tehran is proposed and approved. This plan in March 2004 to identify land suitable for the construction of stations to the region be notified to 22 urban districts of Tehran [2]. Given vulnerability of Iran in during a disaster, planning and carrying out studies to reduce various effects and consequences arising from it seems necessary. Rasht city with a population of 600 thousand is in an area with a high risk of earthquakes, floods, landslides, snow, fire, etc. Witness of this claim includes earthquakes in June 1990, heavy snow years 2005 and 2008 and fires and repeated flooding in the city.
In relation to temporary accommodation in crisis has done research that following some of them will be described briefly.
[3] in study with title "locating relief centers (in conditions of earthquake) using GIS and multi criteria evaluation method AHP" examined this issue and finally were identified some place as a relief centers for rescue operations in case of crisis in the districts of 11 of Tehran Municipality. [4] in paper with title "locating

of temporary accommodation for unexpected disaster management based on the use of Geographic Information Systems (GIS) Smart" investigated this topic. In this study, distance from health centers, distance from the pressure reducing stations, gas and electric, the distance from the station and fire centers, distance from the gas station, gas, height of the building and area of green space is considered as the main variables. Finally, based on these indicators and using the GIS software attempts to locate vulnerable areas for temporary accommodation in crisis. in study with title "Locating help centers and accommodation" in district 1 of Tehran Municipality determined suitable locations for establishment of relief centers after outbreak of the crisis, especially (earthquake). In these study, the criteria for locating relief centers and accommodation consists of four indicators of safety, efficiency, effectiveness and equipped. in research with title "The optimal locating of temporary accommodation for victims of the earthquake in urban areas" review this topic in city of Zanjan and finally, based on specific criteria attempted to identify areas suitable for temporary accommodation of victims in situations outbreak of the crisis and disaster. [5] in other study investigate locating the optimal of support base in crisis management using geographic information systems in region 6th of Tehran municipality.

Due to the occurrence background such natural disasters in region, planning before the event is one of the main objectives of urban management (crisis management) that can provide good place in terms of physical, security, social for citizens, and city be any place where is preserved human dignity in it and provide a quick return to normal life for people damaged. Scientific and accurate locating temporary accommodation sites and silos for the equipment maintenance and food needed for servicing in time of crisis is one of the requirements for achieving such an objective. in these regard, this study intends according to the criteria and indicators (such as access to arterial pathways, access to airports and terminals, located in open lands and parks and green spaces, away from areas of risk and .....) do to zoning and locating temporary accommodation sites and silos of equipment maintenance and food requirements in the event of a disaster (crisis) in the city of Rasht. To achieve this goal it is necessary to answer a few questions, first are temporary accommodation sites and equipment maintenance and food silos in the event of disasters in city of Rasht quantitatively and qualitatively in accordance with standards of the population and criteria of construction and design? And second are the spatial distribution and site selection of temporary accommodation sites and equipment maintenance and food silos in the event of disasters in city of Rasht, in accordance with the principles and criteria of locating?

2. Theoretical Foundations

2.1. Theoretical Foundations

Development of city and urbanization and gradual rise in major cities in the world especially in developing countries including Iran, on the one hand and urban growth, centralization of population and economic and environmental loadings in them, more attention to the cities has led to the adoption of different roles and performances. One of the most important issues facing the world's largest cities is the subject of natural disasters. Due to the unexpected nature of these events and the need to adopt quick and correct decisions and execute operations, the theoretical and fundamental has created a knowledge entitled crisis management. This knowledge is said to set actions that before, during and after the crisis is done to reduce accidents and reduce vulnerability. By using the principles and criteria of urban planning and explain the concepts of available at this knowledge Like structure of the city, urban land use, communication network and urban infrastructure can be reduced greatly impacts and consequences of natural disasters [6]. Crisis management is part of an extensive chain as follows:

Planning: Planning for disaster management institutions in the best position is respond to the incident and then improving crisis. Planning has two basic elements:

A. creating and aggravating the rules for individuals

B: Creating a crisis team

2 - In response to the incident: it is an automated process that the crisis management agencies achieve ensure in during it that People react properly to the crisis. Aware is key point in this element[7]. Emergency response of organization is the primary needs in crisis management that through data collection and analysis it will be implemented decision-making and monitoring implementation in the shortest possible time [8 , 9] (Mendonca , Beroggi , Van Gent , Wallace,2006:633) and he argues that local government in the city is the most appropriate system to deal with natural disasters, particularly due to their closeness to government as sub-branches of government and as well as applying local associations for disaster management in the local level . In understanding of natural systems of human interactions and the environment is useful that create the two issues in mind. One is interaction of components and another area of risk in assessment. In evaluating these two issues,

review of physical processes in risk, evaluating the character of human populations and adjust them based on risk, measuring vulnerability and exposure to risk and human responses and costs should be analyzed and evaluated. Based on this vulnerability can be defined measuring facing an individual or group in the effects of natural hazards and also measuring the degree of improvement groups and individuals after occurring event [10].
Smith divided into two categories disastrous effects.
A: direct
B: indirect
Direct consequence effects happened in the first day that emerges immediately after the event or disaster. Costs of direct effects in disaster are the most visible and therefore the most costs in disaster. Indirect effects refer to the indirect effects after emergence of the disaster that includes disorders of economic-social, and emotional of community that is considered less. Community's ability to recover after the events is determined by a range of factors. However, factor of center core for position of each community to respond disaster is capacity of the community management that based on the capital and available resources and mobilize of assets can be maximized center core factor [9].

Figure 1: The cyclical model of crisis management[11].

2.2. Relief

Relief process includes all actions which will be implemented in the moments after the crisis. These measures are done to save lives of human and protect property and assets and also relieve losses incurred [12].

3. Location of studied area

Rasht city is located in center of Guilan plain, in the range between 49 degrees and 35 minutes and 45 seconds east longitude and 37 degrees and 16 minutes and 30 seconds north latitude(Figure 2).
Its area is about 10,240 hectares. This city is limited from north to Khomami and from south to Lakan village and Roudbar city, from West to Some'esara and city of shaft and from East to Kuchesfahan district and Sangar. Rasht city with a population of 639, 951 people in 2011 has allocated about 25.8 percent of population in guilan province [13]. Rasht is considered as the first and largest urban area of province and the southern margin in the Caspian Sea and as political and administrative center of Guilan province[14].

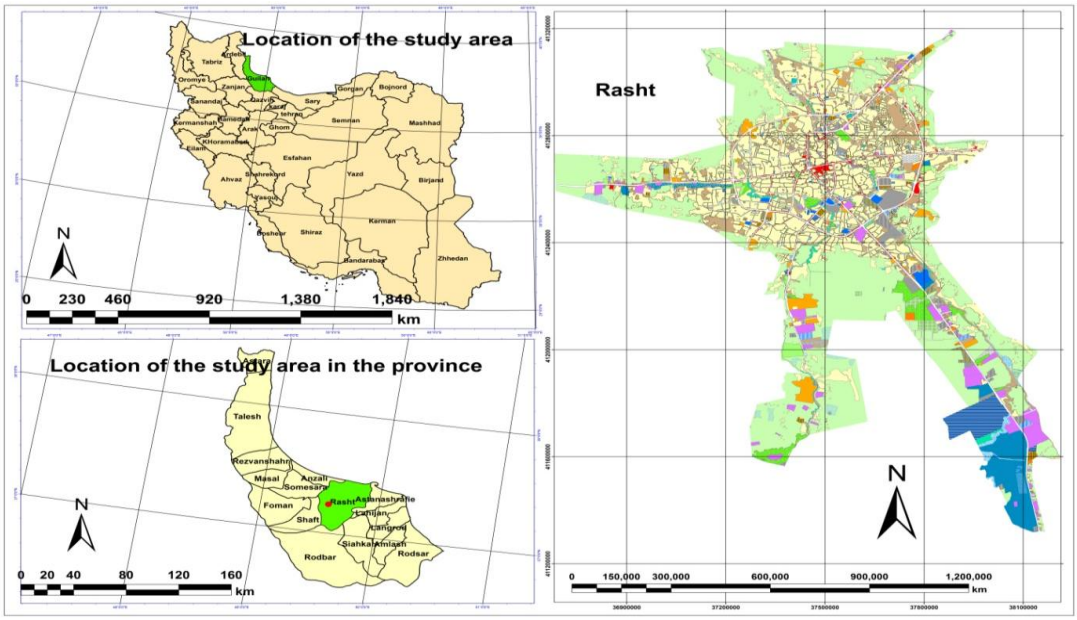

Figure 2: Geographical location of Rasht city in the country, province and city

4. Research Methodology

Research method is descriptive - analytical and type of applied. To achieve the desired goals, the first step with estimate the population of vulnerable areas is calculated number and area of sites required to the forecast horizon and then using the analytic hierarchy process (AHP) and based on certain factors such as stability, security, availability, compliance and ... will be determined a suitable place to build temporary accommodation sites and silos for equipment maintenance and food required for servicing at time of crisis in Rasht city. To do this work in a GIS environment and using AHP model is considered five steps:

The first step: in this step is to decide what layers of information is needed, such as the persistence layer, access, population, verge and natural hazards.

Second step: the production and creation of information layers required from input information layers.

Third step: a survey of related experts in relation to the weight of each criterion and sub-criteria in locating sites desired.

Fourth Step: Classification of information layers based on weight of sub-criteria for each layer.

Fifth Step: weighting and integrating information layers based on expert opinion and using and software of Expert Choise.

In this study is used the software ArcGIS, AutoCAD, Expert Choice and Spss.

5. Research Findings

1.5. Investigating the situation of the emergency services centers in the event of a crisis in city of Rasht

Field visits and initial investigation showed that in current situation there are a several sites in the area of crisis management, temporary accommodation and food storage in the city of Rasht which will be discussed briefly:

1.1.5. temporary accommodation sites:

1: multipurpose base of crisis management located at the intersection of Entezam, next to Fire Station No. 5 in Rasht city.

2: land with an area of 2 hectares next to crisis management organization in the road of Rasht-Tehran, front Rezvan garden.

3: Camping Accommodation in Mellat Garden

4. Land in the road of Fooman - Some'esara, next to Eynak lagoon.

2.1.5. warehouses and silos of food storage

1: silos 1, 2 and 3 food storage at the site of Red Crescent of Rasht located in Road of Rasht - Anzali after Valiasr square.

2: silos of 5 and 6 food storage located in Jirdeh, Shaft Road, after school of intelligent analysts.

2.5. Determining location suitable for establishment of emergency services centers in the event of a crisis (temporary accommodation sites and silos of equipment maintenance and food)

Since the crisis management is process that can prevent crisis or in the event of it efforts to reduction its effects, creation of necessary preparation, response, speed relief and recovery conditions to achieve normal conditions and reconstruction [15]. What happens in times of crisis, in addition to the loss of life and property, as well as follow many social losses. Given the great importance of the issue of housing and settlements for humans, forecasting and implementation of temporary accommodation locations for victims of accidents are inevitable, but has primacy and high priority. Serious forecasting emergency and temporary accommodation is one of the main tasks of disaster management planners in each of administrative system and planning. Because injured man without shelter are faced with the verge of serious injuries of physical, emotional and mental. In the absence of accurate and timely predictions in this field, community damaged will be seen negative and irreversible feedback for current and future generations of disaster. Nowadays psychological aftermath issue after disasters is one of the main concerns of crisis management custodians in developed countries. Because the role of locating and temporary accommodation of the victims in places predicted, is important in urban planning and urban development [16].

Analytical Hierarchy Process (AHP): Multi-criteria decision-making methods (MCDM) includes all methods with structure that helps individuals, make decisions based on their desire and based on more than one criterion [17]. In other words, multi-criteria analysis usually provides conditions which decision-makers to determine the performance of each option according to each criterion, and determining the relative importance of criteria with respect to the main objective provide qualitative assessments [18]. AHP method is a method of multi-criteria decision [19], that provide possible to quantifying intangible factors to decision makers [20].

3.5. To perform Location analysis should be gone that this process includes following theoretical and practical steps:

1.3.5. Identifying the variables and evaluation criteria

Place is a conscious and voluntary act center of human [21]. The suitability of a particular place for a service, to a large extent depend on factors that are evaluated and selected during the locating a service [22]. In the selection of evaluation criteria, the general rule is that these criteria should be determined in relation to situation of problem [23]. To determine the optimum location order to establishment of emergency services In the event of a crisis in city of Rasht variables and the following criteria are considered (Table 2).

2.3.5. The entry of variables and criteria to geographic information system (GIS)

This step is a process that consists of data collection, changing format, land referencing, set-up and documenting data.

3.3.5. Development of new information layers

At this step given the available data is prepared a new layer of information based on indicators used in this research.

3.3.5. The classification and valuation of variables and information layers

This step is one of main steps of locating using a geographic information system, data collection re-classified and valued. Operation of reclassification was necessary to combine all layers and during this operation, all the layers are measured under the same scale [24]. In this study, for valuation of information layer is used model (AHP). This technique is based according to paired comparisons and gives possible to check various scenarios to managers [25]. Method based on analytic hierarchy (AHP) is based on three principles: analysis, comparative judgment and composition of priorities [26]. For binary comparison method takes the following steps:

1.3.3.5. Creating binary comparison matrix:

In this method, the weighting to criteria is done by the Software of Expert Choise. The method of work is way that initially, is caused a hierarchy of intended problem. In this hierarchy of objectives is determined criteria and sub criteria. Then elements in each level of the hierarchy are evaluated respectively from bottom to top compared to all associated elements at a higher level. Hence decision options is evaluated based on the latest level of decisions indicators and on the other is evaluated other indicators decision. Finally paired comparison matrix forms that compared to importance of factor are from number 1 to 9. In this research in the field has been used opinion of urban planning experts.

Table 2: criteria for locating Emergency operation centers

row	Criterion	standards
1	Access to bus service terminals and airports	**The most favorable distance from this land uses is 500 meters
2	Establishment in parks, open spaces and wasteland	*The most desirable distance with these spaces is considered 500 meters
3	Access to urban arterial and main roads	*The most desirable distance from these type pathways is 200 meters
4	Access to health centers	**The most favorable distance from this land uses is 1000 meters
5	Access to the fire station	**The most favorable distance for fire station is 1000 m
6	Distance from faults and lands exposed to drift and landslide	*considering the boundary is 200m
7	Distance from high pressure power lines, gas transfer lines and gas pressure reducing stations and fuel storage centers and refineries	*considering the boundary is 200m
8	Distance from production centers of pollutants (landfills, cemeteries, etc.)	*considering the boundary is 1000m
9	Distance from the vicinity of the river	*considering the boundary is 100m
10	Distance from areas of pond	*considering the boundary is 100m
11	Deployment in appropriate height places	**Height above 30 meters is more desirable
12	Deployment in areas with high population density	*Minimum distance from residential areas with a high density
13	Access to military centers and law enforcement	**The most favorable distance from this land uses is 200 meters
14	Access to educational centers (elementary school)	**The most favorable distance from this land uses is 500 meters
15	Access to markets of daily, weekly and squares of fruits and vegetables and nuts	**The most favorable distance from this land uses is 500 meters
16	Establishing in proper slope	**The most favorable slope is between 2 and 7 percent.

*: these standards have been set by organization of prevention and crisis management in Tehran.
**These standards have been applied based on expert opinion.

2.3.3.5. Calculating weight of criteria:

After the formation of comparison matrix, respectively, in the following, is obtained the relative weight of criteria:
First step: calculating sum of value of each column in the matrix of paired comparisons.
Second step: standardizing matrix numbers, this means that each component of the matrix obtained from paired comparisons is divided by the total column and is obtained paired comparison matrix normalized. Normalized number for i and j is obtained from following equation (formula):

$$Nij=\frac{Vi\ و\ j}{\sum_{i}^{n}=1\ vi\ و\ j}$$

That in this formula j and Vi paired comparison matrix elements, Nij index of elements normalized and n number of elements is compared.
Third Step: calculation of components mean in each row of matrix is standardized. Namely sum of the standardized scores for each row divide to number criteria result of matrix columns. These means is estimate of the relative weights of the criteria compared. This is done using the following equation (formula):

$$Wi=\frac{\sum_{i\ و j}^{n}\ ni\ و\ j}{Vi\ و\ j}$$

In this equation, Wi index is the relative weight and n is the number of criteria that finally is obtained the final weight. Final weight is the basis for the decision and can be applied as efficiency ratio of both criteria to achieve

the ultimate goal. The following table shows the weight and rating criteria and information layers using a paired comparison method [24].

6. Analysis of Land in Rasht city based on the specified criteria

As it stated earlier, in the present study for locating suitable land order to the establishment of emergency services centers in the event of a crisis in the city of Rasht is considered 16 indicators. Following based on these indicators and in framework of analytic hierarchy process model will be attempted to analyze land in the city of Rasht.

1.6. Access to bus service terminals and airports and the establishment in parks, open spaces and wasteland and access to urban arterial and main roads

The first priority of designing emergency accommodation spaces in parks, available green spaces and forest parks by considering minimal requirements in order to multifunctional use from these spaces and possible maintenance and exploitation by municipalities and in times of crisis as emergency accommodation site and in normal times is as the promenade. Also locating the location of emergency accommodation sites must have convenient access to nearly airport as possible, railways, highways and points of entry and urban terminals. Most optimal distance from the terminals and park is 500 meters and from arterial passageways is 200 meters.

2.6. Access to health centers and fire stations

Near fire centers to temporary accommodation is considered strength points of temporary accommodation planning, according to standard best distance from fire station is about 1 km. Health centers without a doubt is the most basic needs of a city in times of crisis. Given the importance of easy access to these centers, most desirable distance from small health centers and clinics is 700 meters and from hospital is considered 1.5 km [27].

3.6. Distance from faults and lands exposed to drift and landslide and distance from high pressure power lines, gas transfer lines and gas pressure reducing stations and fuel storage centers and refineries

To avoid the dangers of high pressure power lines, gas lines and current fault are required their reasonable distance to meet the physical health of citizens. Places of temporary accommodation should be having facilities and above centers at least 200 meters distance.

4.6. Distance from production centers of pollutants (landfills, cemeteries, etc.)

Proposed locations for emergency accommodation centers should be have at least 1 km distance from producing pollutants, landfills, cemetery, and production center of harmful creatures such as mosquitoes and industrial waste production and hospital.

5.6. Distance from the vicinity of the river and areas of pond and deployment in appropriate height places

According to studies conducted hydrology, the proposed site should not be prone to flooding and waterlogging. Accordingly it should be have at least 100 meters distance from the river and pond areas and it is better that lands be with a height of over 30 meters.

6.6. Deployment in areas with high population density

High population density in cities means more losses and damages in the event of a crisis[27]. Thus, areas with a high density, in locating temporary accommodation have planning priority.

7.6. Access to military centers and law enforcement

Due to the necessity of establishing public order and also providing security of residents in temporary accommodation camps, access to military centers and law enforcement is one of the most important indicators. About police station Best distance in terms of walking access in a time of crisis is considered 200 meters and about garrison in terms of their distribution patterns at level of city is considered 1 to 2 km[28].

8.6. Access to educational centers (elementary school)

In order to facilitate the movement and for continuing motivation of training and education in children and adolescents, locating temporary accommodation should be such that have be minimum distance of elementary schools. According to the regulations of urban development, functional radius of urban elementary education centers considers 500-700 meters [29]

9.6. Access to markets of daily, weekly and squares of fruits and vegetables and nuts

According to establishment of large number of people in temporary accommodation sites in the event of a crisis, discussion of access this population to the market of daily, weekly and squares of fruit and vegetable and nuts in the quickest time possible is very important. The most optimal distance of these land uses is 500 meters

10.6. Establishing in proper slope

General slope of land in temporary accommodation places should be moderate and among 2 to 7 percent. This value of the slope facilitates drainage. Land with steep slopes (10% and above) are problematic and costly and should be avoided from it. Also lands of flat and smooth in rainfall seasons may be pond and bund [30].

7. Preparing and mixing layers order to identify sites of temporary accommodation in emergency situations

At this step the first layer of information provided to each of the criteria according to the rules for each criterion were prepared in Arc GIS software. Then because of the importance of not same information layers in locating temporary accommodation sites, all layers of information were prioritized using the comments of experts in terms of importance and the weight of the layers was determined using Expert Choice software. In Next step weights obtained for each criteria in analytic hierarchy process (AHP) be multiplied in layer related to it. Finally, with integration of all information layers were formed final layer overlapped of temporary accommodation sites (Figures 3 and 4).

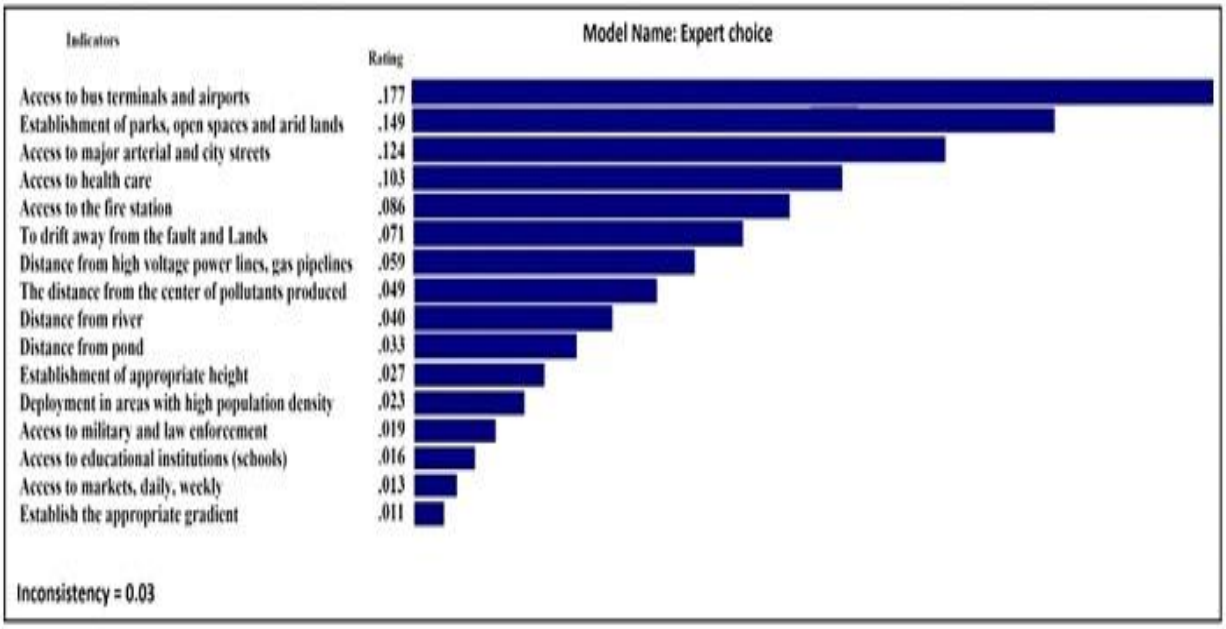

Figure 3: Figure of weighting main criteria for locating temporary accommodation sites

The following table information is the results of matching final map of model locating for temporary emergency accommodation sites in emergency situations and food storage silos with map of site selection in current status of sites mentioned in the city of Rasht. Accordingly, it was found that from 4 sites of existing emergency accommodation, 2 sites is in areas with good value and 2 sites is in areas with moderate value and 1 site located in weak areas and food storage silos of Jirdeh- Shaft roads is in weak areas and also food storage silos at site of Red Crescent in Rasht in Road of Rasht - Anzali have been located with good value and very good in land area.

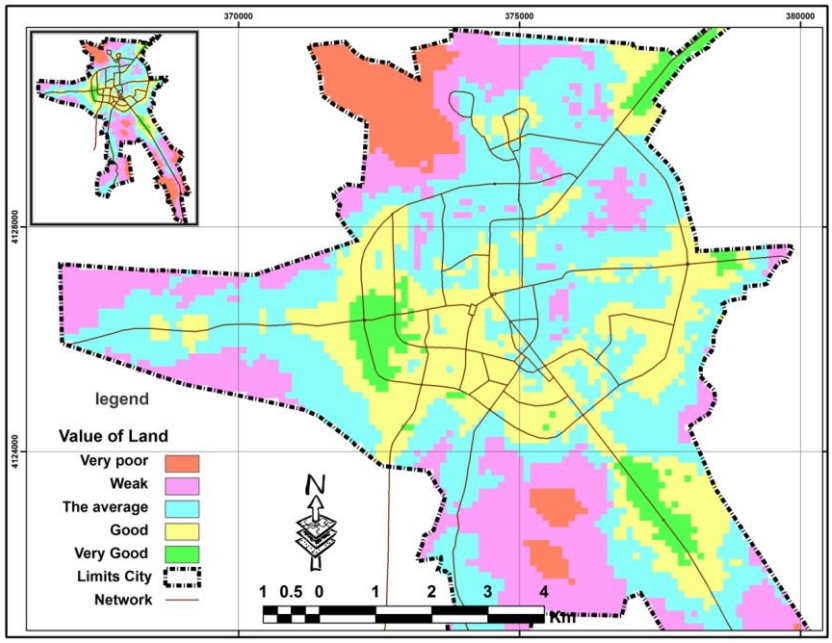

Figure 4: prone zones map for locating sites of temporary accommodation in emergency situations

8. Evaluating the situation of site selection for temporary accommodation sites and food storage centers in the city of Rasht with the final map obtained from model locating

Table 3: Evaluation of Site selection in existing site

row	Characteristics of Site	Situation of Site Selection
1	Multifunctional station of crisis management located at the intersection of Entezam, next to fire station No. 5 in Rasht	Good
2	land with an area of 2 hectares next to organization of Crisis Management located in road of Rasht - Tehran, front Rizwan garden	weak
3	Camping accommodation in Mellat Garden	Moderate
4	land in road of fooman - Some'esara, next to eynak lagoon	Moderate
5	Sites 1, 2 and 3 food storage at the site of Rasht Red Crescent located in Road of Rasht - Anzali after square of Valiasser.	Good and very good
6	Silos 5 and 6 of Food storage located in road of Jirdeh, Shaft, after school of intelligent analysts.	weak

Source: research findings

Conclusions and recommendations

Identify potential locations for the construction of temporary housing and food storage aimed at providing victims during natural disasters the policy response to the crisis and improving the level of preparedness of government agencies. In addition to this, the identification of locations susceptible to a variety of additional functions can be.

This enables city managers to the crisis part of its power to identify possible risk spending plan and provide better service to survivors of natural disasters and their increasing citizen satisfaction. major consequence of this is a better understanding of the crises of natural conditions that are impossible to forecast. In this study, different criteria for locating temporary housing sites identified using the Delphi method, and then type of relationship compatibility and incompatibility criteria with temporary accommodation sites and standard level accessibility and distance of these criteria. In the next step was calculated the weight of each sub-criteria for main indicators 16 and information layer of each criteria were produced based on it. Then due to the importance of not same information layers in locating temporary accommodation sites, all layers of information were prioritized using the comments of experts in terms of importance and the weight of the layers was determined using Expert Choice software. In Next step weights obtained for each criteria in analytic hierarchy process (AHP) be

multiplied In layer related to it. Finally, with integration of all information layers were formed final layer overlapped of temporary accommodation sites.
The findings suggest that the use of existing facilities in good condition there, and in the event of a real disaster, many people lack basic amenities consequently, resulting in pressure on crisis management and a lack of proper accountability them (Figure 5).

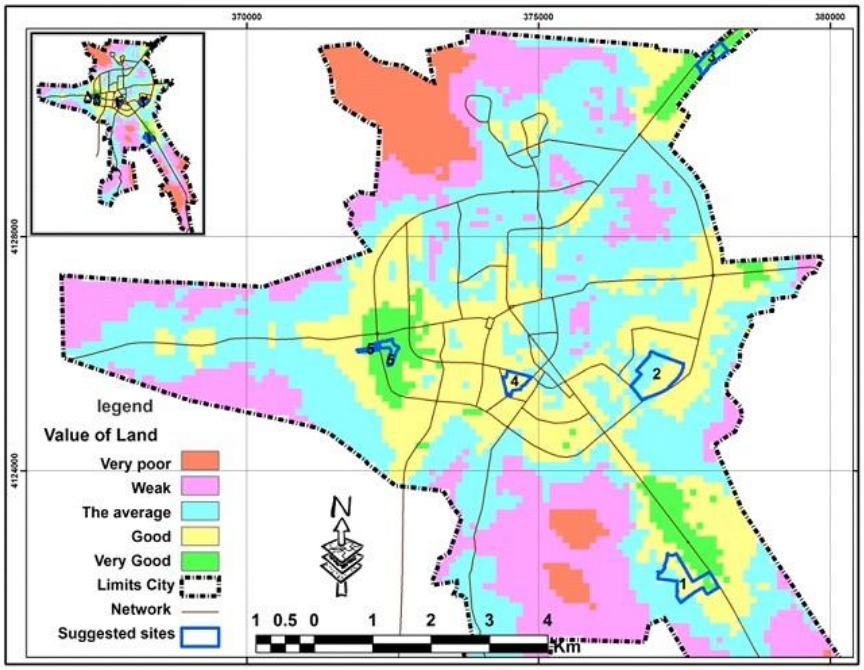

Figure 5: Map of proposed sites for temporary accommodation in emergencies

Acknowledgement - The project approval and financial support PNU Guilan province was conducted. Finally, the efforts and financial and technical support PNU Appreciating I Guilan province.

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