EVALUATION OF WATER PUMPING STATIONS BY VIEW OF PASSIVE DEFENSE, WITH TOPSIS MODEL (CASE STUDY: MASHHAD CITY)


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Abstract. Location is one of the most challenging issues in today's world. Due to the natural and abnormal hazards, determining the appropriate location for the construction of each structure is based on a set of principles. These principles are comprehensively and managed in the form of non-operational defense principles.

In this research, using the multivariate decision-making space in TOPSIS software, the ideal answer from the multivariate analysis including economics, earthquake hazard, Territorial and military factors under the supervision of a bachelor to assess four pumping stations in the city of Mashhad and the suburbs Came.

The results of the four pumping stations showed that the pumping station of Manzelabad in terms of applying the comments of all experts with a correction factor of 0.57 in the highest and Dosti Dam pumping station in the worst case with a preference factor of 0.44.

Analysis of the effect of each of the four criteria indicated that the Manzelabad pumping station had more vulnerability to earthquake and military hazard than other pumping stations; in order to address the weaknesses and improve the situation of this location, two burial scenarios In order to enhance the structural strength and also to create suitable vegetation around the ManzelABad pumping station, it was proposed.

The results of this analysis showed that the effect of these two changes on the status of the pumping station of Meziel babad is effective and can reduce its relative vulnerability to the three pumping stations of Dosti, Saber and Toroq D am.

Keywords. Pumping station, Location, passive defense, multi-criteria decision making, TOPSIS

1. INTRODUCTION

Determining the proper location for the construction and construction of any structure requires considering many factors that create a safe and proper condition in its structure. This means that, with the passage of time, imposing effective location affairs will cause the damage and potential damage to it to decrease and, as far as possible, increase the life of the building. Over the lifetime of each structure, many threats threaten its structure. These threats are classified into both natural and abnormal threats. Since each of these two categories is different in nature, the way to deal with them is also very important.

Today, natural hazards, such as earthquakes, endanger the presence of structures, and considering appropriate improvements to structural upgrading can be effective.

On the other hand, the creation of any project requires financial estimation, because economic analysis can restore the financial crisis, especially in our country, to a certain extent. It should be mentioned that these financial and economic evolution before starting any project can change the viability of project in total and finally increase or decrease the level of development of a country can directly or indirectly influences the welfare of people who are living there by changing their decision regarding saving and consumption. Previous studies argued that the level of financial and economic development of a country as such as land acquisition costs and the required budget for construction and utilization must be decisive with engineering and operational visibility. On the other hand, with the growth and development of the world of technology, especially military affairs, and how to deal with them, it has a significant role in reducing operational losses.

For many years, the world has been able to overcome many military threats through a new and effective approach. Briefly, the factors that cause the loss of life and financial resources as much as possible without the direct involvement of military equipment; defective defense is known. It can be used in the categories of principles and important elements of the structure structure and the exploitation of any facilities and facilities.

Switzerland has a long history of neutrality in global affairs, so that the country has not entered into any war since 1815. In 1959, the Swiss people voted in favor of adding the passive defense clause to the constitution of the central government (Karimzadegan and Bagheri, 2009).

The country is symbolized by the non-operational defense of the country, and it has no threats and a neutral state in Europe, but it looks ahead and there is a strong non-operating defense in that country. Switzerland has no natural resources but has one of the highest per capita income in the world, and its economy is based on industry, agriculture, tourism, banking and insurance.

The non-operating Swiss defense program began with much more seriousness from the early 1960s. In Switzerland, the CDO, a civilian and non-governmental or organization, carries out passive defense plans.

Civil defense planners and non-operating civilians argue that the war for a nation's life is not confined to the military front. The goal of any state in a full-fledged conflict is to preserve its survival, including the continuation of economic, financial, spiritual resources and, in short, its entire civilian population. Many of its facilities and facilities are dual-purpose and, in addition to different applications under normal conditions, will become sheltered in times of crisis. People and national and private companies will receive financial assistance in the event of non-operational defense standards from governments, and build Shelter is required in schools, universities and similar centers.

Providing an appropriate solution for managing water crisis in the macro to the neighborhoods, by presenting the case studies on the establishment of rescue water supply facilities and case studies in the design of water supply networks (Farhoudi, 2009). Therefore, considering the sensitivity of this critical element, it is suggested to study the status quo and to investigate the points of incident and transfer it from the danger areas and carry out detailed and executive studies to improve the modification and, finally, to strengthen the existing facilities and how to mobilize. Facilities at the time of the incident.

Any program designed and implemented under this heading should, in addition to addressing security and economic issues, seek to increase the country's capacity to deal with threats and possible attacks, and to enhance the capacity and threshold of national tolerance for dealing with emergencies. Hyun, 2014). Accordingly, urban and rural water and wastewater companies and competent consultants should take action in conducting in-field defense studies in the projects under study, in operation and in operation facilities. These studies are carried out according to the circumstances, situation and location of the project. In any case, inertial defense plans should include identifying and anticipating threats, identifying threats, risk reduction and countering threats, investigating possible damage caused by enemy attacks, ways to reduce and control damages, and remedy and repair damages. It is very important for the time being, in order to punch the famine of the water. People, companies, institutions, governments and states are not going to take new measures to tackle water scarcity, (Sedighi, 2007).

Managing water crisis and implementing non-operati
onal defense strategies are crucial at this time.

Intelligent water management has been a good solution in countries such as the United States, the European Union, Singapore, Australia and Japan. Research results indicate that an appropriate approach has been put in place to implement the legal framework for intelligent management in these areas facing climate change. The optimal allocation and distribution of service centers is a problem that most planners are dealing with. The balanced distribution of these spaces requires the establishment of appropriate facilities and facilities in such a way that all segments of society can access them equitably (Javari, 2010).

Among these uses, the placement of educational spaces is important because of their importance with the proximity of heterogeneous applications and the lack of adjacency with heterogeneous applications, as well as the consideration of environmentally and physically tolerable conditions such as comfort, efficiency, health and safety of necessity has it. In this paper, using the geographic information system and spatial analysis, we used the spatial data analysis to select the best places for Payam Noor University. Using the minimum distance from the desired indicators (commercial, educational, residential, military, main roads, mountains and rocks, cemeteries, etc.) and rating of user applications based on the amount of economic value and physical fitness to create them, and the extent and bound aries of the city of Khoramabad based on the amount and GIS of the university. In a value-added environment, they are divid ed into five groups: very good, good, medium, weak and very weak.

Today’s growth in population and increasing demand for water with better quality of intensified competition between water demand in different sectors of agriculture, industry and drink. Increasing water use per capita due to improving the welfare and health of people. The crisis caused by droughts and atmospheric fluctuations and excessive water withdrawals. Groundwater has been important for water resource management. The purpose of this research is to find the right place to establish a drinking water treatment plant with respect to groundwater quality parameters (Habibi Daouja ni et al., 2012).

In recent years, due to the superiority of ground-base methods, researchers have been using these methods to draw up a map of groundwater properties due to the superiority of ground-based methods. The choice of the location of the water treatment plant should be due to the quality of the aquifer, due to the presence of heavy metals and water hardness. And the requirements for improving the quality of water extracted. Using geostatistical methods and fuzzy logic in GIS, taking into account 14 basic water quality parameters, the location of the best groundwater extraction point in the region was studied and finally, an uncertainty analysis was used to estimate the accuracy of the data.

Since the issue of location determination is high, there are several methods in this regard. And in addition to the actions of the non-operational defense principles this could be the solution. In this research, using the TOPSIS software, a multi-criteria decision making problem was designed in the framework of evaluation of four water pumping stations. By applying four basic criteria, these stations were analyzed and their weaknesses were determined based on these principles.

2. MATERIALS AND METHODS

2.1. TOPSIS Model

Due to the multiplicity of different criteria and scenarios, it is difficult to apply a decent decision and determine the best place of work. Therefore, TOPSIS software is used to locate this research. The topsis model is a multivariate decision making, (Çiftcioglu, Almasi fard 2015). In this method, the m option is evaluated by the n index, so any problem can be considered as a geometric system including the m point in a n dimensional space. This technique is based on the notion that the choice option should be the minimum distance with the ideal ideal solution (Ai +), the solution that is among the most positive criteria, the least and among the least negative criteria, and the greatest distance through the path. The ideal negative solution (Ai) means the solution that is among the most negative criteria and the least among the positive criteria. The TOPSIS technique compares decision-making criteria and introduces the superior option by presenting a higher impact factor.

2.2 How to choose Criteria and Scoring

Several factors are involved in determining the location of a pumping station. These factors could be hydraulic characteristics or other considerations. In this research, considering the goal of evaluating the four stations of water pumping from the point of view of defensive defense. Table 1 presents the name and position of the four pumping stations examined. Among the different criteria of this research, four criteria that were considered by the experts as the basic and challenging criteria of the city of Mashhad were raised.
### Table 1: Specifications of mashhad pumping stations

<table>
<thead>
<tr>
<th>Address</th>
<th>Pumping Station Name</th>
<th>NO.</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>In the vicinity of ManzelAbad village, Quchan old road sidewalk</td>
<td>ManzelAbad</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Sayad Shirazi 56th, Saber Alley</td>
<td>Kardeh Dam</td>
<td>2</td>
<td>Distance from the first military territory</td>
</tr>
<tr>
<td>4th kilometer of deh gheybi road</td>
<td>Toroq Dam</td>
<td>3</td>
<td>quantitative military</td>
</tr>
<tr>
<td>Shahid Kalntari Highway sidewalk, in front of Koohsangi, in the vicinity of Ayeha center</td>
<td>Doosti Dam</td>
<td>4</td>
<td></td>
</tr>
</tbody>
</table>

In this research, decision-making criteria are categorized into two categories of qualitative and quantitative criteria. Qualitative criteria are criteria that are not measurable and can only be differentiated by rating. Also, measurable measures that are not dimensional and do not require a concession rating are quantitative criteria. In order to categorize the exact criteria and analyze them, the other two categories are defined as the profit (+) and cost (-) criteria that can be identified in the TOPSIS model. The benchmark for profit means that as much as its privilege increases, the power of the benchmark will increase in the introduction of the desired location. And vice versa, in terms of cost criteria, if the score is lower, its effect is to lower the location of the pumping station. Non-functional defense decision-making criteria are presented in two qualitative and quantitative categories in Table 2.

### Table 2: Category of criterion

<table>
<thead>
<tr>
<th>Criterion</th>
<th>Evaluation tool</th>
<th>Criterion type (qualitative or quantitative)</th>
<th>Criterion</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cost</td>
<td>Territorial appropriation (Rial)</td>
<td>quantitative</td>
<td></td>
</tr>
<tr>
<td>Benefit</td>
<td>Distance from the fault (Km)</td>
<td>quantitative</td>
<td></td>
</tr>
<tr>
<td>Benefit</td>
<td>Distance from the first</td>
<td>quantitative</td>
<td></td>
</tr>
</tbody>
</table>

For easy and appropriate evaluation of the location of the pumping stations, four pumping stations are ranked in four ratios for each criterion, and the concession rating to each rank is determined according to Table 3 from 0 to 20.

### Table 3: Rate each rate and description

<table>
<thead>
<tr>
<th>Criterion point (0-20)</th>
<th>Description</th>
<th>Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>20</td>
<td>Very appropriate</td>
<td>1</td>
</tr>
<tr>
<td>15</td>
<td>Appropriate</td>
<td>2</td>
</tr>
<tr>
<td>10</td>
<td>Fairly appropriate</td>
<td>3</td>
</tr>
<tr>
<td>5</td>
<td>Inappropriate</td>
<td>4</td>
</tr>
</tbody>
</table>

The questionnaire was defined as the value of each criterion, and 10 experts evaluated the value of each criterion from 1 to 9. Table 4 presents the average weight of each criterion based on the expert opinion.

### Table 4: Average weight of each criterion based on opinion 10 expert

<table>
<thead>
<tr>
<th>Average weight (1-9)</th>
<th>Criterion</th>
</tr>
</thead>
<tbody>
<tr>
<td>9</td>
<td>Economic</td>
</tr>
<tr>
<td>6</td>
<td>Earthquake hazard</td>
</tr>
<tr>
<td>8</td>
<td>Territorial</td>
</tr>
<tr>
<td>7</td>
<td>Military</td>
</tr>
</tbody>
</table>

The results are presented in three sections including the application of expert opinion, the determination of the effect of each criterion, and the resolution of the vulnerabilities of the vulnerable pumping station.

1.3 Based on the average weight of Expert's opinion...
Using the data mentioned in the tables above and the TOPSIS software, the preference factor of each pumping station was determined. In order to determine the mean weight of experts, experienced and familiar with the questions of the questionnaire? Figure 1 shows the information page to the topsis. Where the score of each scenario is displayed according to the benchmark examined.

It should be noted that the cost criteria are red and the profit criteria are displayed in blue? In addition, four scenarios for the location of the pumping station are also shown in the picture. Figure 2 shows the appropriate location among the four pumping stations on the basis of the preference factor.

Based on Fig. 2, the highest location among the four pumping stations mentioned above, ManzelAbad area with a preference factor of 0.57, and on Alka, Kohsangi home, which is located at the Dosti Dam dampment station. In the worst case scenario, the preference factor is 0.44. The Toraq and Saber pumping stations are also slightly different in the next category.

### 2.3. Effects of criterion weight

In this study, the effect of the criterion weight of each criterion is analysed separately. Therefore, in this case, the weight of the benchmark, the criterion under consideration, which is to be determined in determining the location, is assumed to be 9, and the other criteria are analyzed with a moderate weight, which is 5. Table 5 summarizes Vern's analysis of the criterion of location selection.

<table>
<thead>
<tr>
<th>Scenario</th>
<th>Criteria</th>
<th>Worst option</th>
<th>Best option</th>
<th>Preference factor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Economic</td>
<td></td>
<td></td>
<td></td>
<td>0.59</td>
</tr>
<tr>
<td>Saber</td>
<td>ManzelAbad</td>
<td>0.45</td>
<td>Taroq Dam</td>
<td>0.54</td>
</tr>
<tr>
<td>Dosti Dam</td>
<td>Doosti Dam</td>
<td>0.39</td>
<td>Taroq Dam</td>
<td>0.61</td>
</tr>
</tbody>
</table>

It is worth noting that, economically, the Dosti Dam pumping station in the Kuhsangi region is in the worst situation, in this case, many costs have been paid for land tenure, and the non-operating defense plan in the field only suggests the construction of pumping stations in Low cost areas like the Torq or Saber, and in addition, are recommended to apply a suitable method for the economic sector in all selected location projects. On the other hand, the home-pumping station in terms of earthquake hazard will prioritize the reconstruction and upgrading of structural strength, and it is better to adopt retrofitting measures in this regard. In the
state of land conditions, the pumping station of the dam is not in a suitable location. Also, in the case of the effect of military agents, the pumping station is very vulnerable. In this regard, some non-operating defenses can be used to secure this location. Such as deception, hiding and vegetation. In the next section, with the suggestion of practical solutions, the safety factor of higher pumping stations is exceeded. According to Table 5, the home-pumping station is vulnerable to earthquake and military risks and some basic steps must be taken to ensure security.

2.3. Improvement of the status of pumping stations at Manzelabad

During the survey, it became clear that the pumping station at Manzelabad needed basic considerations to improve the structural and military status. Some measures could be taken in this regard and could be effective in improving the existing situation.

2.3.1. Create vegetation

The first option to improve the status of this plant is to create vegetation to enhance the safety coefficient of the military to detect the enemy's vision. In this case, another criterion is added to the four past criteria. In this scenario, vegetation is assumed to be around the Manzelabad station and the impact of this vegetation on its current status is determined. Accordingly, the benchmark score for the home-pumping station is assumed to be appropriate for the provision of vegetation, and other pumping stations will be rated at 5 points due to lack of suitable vegetation cover. It is noted that in this case the weight of the military standard is 9 and the other criteria, including vegetation criteria, are 5. Figure 3 shows the result of applying vegetation.

![Figure 3 Create vegetation in the MANZELABAD station](image)

It should be noted that as a result of applying appropriate vegetation around the pumping station, the preference factor is higher and ranked secondarily in the military station. In this case, the station's preference factor is 0.48 and the Dosti Dam pumping station is located at the lowest level of military security.

2.3.2. Burial of MANZELABAD pumping station

Another solution is proposed to upgrade the structure of the site to prevent damage to the Manzelabad pumping station; it is to be buried at the station. It is obvious that this station will not be able to be deposited because it is in use and it will no longer be possible to do so. On the other hand, military conditions will be upgraded by burial of this pumping station. But what if the hypothesis scenario was happening at this sampling station, what was the situation in terms of earthquake hazard? Therefore, in this analysis, the rate of burial is added to other criteria, and the benchmark score of the pumping station is 20 and its standard weight is 5, and other pumping stations are rated zero for non-burial. Figure 4 shows the effect of the pumping station burial.

![Figure 4 effect of burial MANZELABAD pumping station](image)

As it is observed, due to the burial of the pumping station, the coefficient of preference, safety, structural strength of the above is higher, so that the coefficient of preference is 0.62 in the best place.

3. CONCLUSION

The application of the principles of non-operating defense, in particular, four fundamental topics, including economic, earthquake, Territorial, and military, have a significant role in choosing the best place. In this regard, in order to analyze the existing status of four pu
Pumping stations in the city of Mashhad, the four basic principles of this study were used. In order to make the highest decision, the multi-criteria decision making problem was created and evaluated in the space of the TOPSIS model. The results of this study showed that by applying the expert opinion, the Manzalabad pumping station was located in the northwest of Mashhad with the preference factor of 0.57, and the most favorable location and pumping station of Dushanbe dam with a preference factor of 0.44 was in the worst condition.

Results from the review? The economic impact on the four places that has taken place shows that the MANZELABAD is in good condition and in the area of the DOSTI DAM is in inappropriate conditions. The effect of the earthquake hazard on the four pumping stations under review indicates that pumping stations of Dost and Manzalabad Dam with the preference coefficients of 0.61 and 0.4 are classified in the worst and worst conditions.

In the section on the effect of Territorial factors, it was found that the TOROQ dam station is inappropriate and the station is home with 0.59 with a preference factor of 0.59. The military agent indicated that the pumping station is vulnerable under critical conditions and Saber Pumping station is suitable with a 0.62 preferred factor. The Manzalabad pumping station was found to be vulnerable to the impact of two criteria of the earthquake and military hazard.

To improve the status of the station- With the burial of the MANZELABAD pumping station, in addition to upgrading the structural strength, the safety factor of the structure can be increased against military threats. In this regard, the carving scenario of the MANZELABAD pumping station caused the station to rank 0.62 with a preference factor of 0.62 and this weakness will be overcome.

REFERENCES


Farhoudi, M (2009), The role of passive defense in reducing damage to water and wastewater installations, The first national conference on engineerin g and management of infrastructure, Tehran, Tehran University.


Dr.Zahra pishghahi fard,Dr.Naser Eghbali,Dr.Beig babayi,Dr.AbdollReza Faraji Rad, (2014)“Geographic Information System (GIS) and its role in locating hazardous urban areas for use in crisis management.”


Dr.Manouchehr faraj zade, Mahdi Fallah, Ali nik khe slat, ,Dr.Hasan vaghar Fard ,(2016) “Locating the wastewater treatment plant with the TOPSIS and GIS technique.”


D. Ozturk a, *, F. Batuk b , (2010)“TECHNIQUE FOR ORDER PREFERENCE BY SIMILARITY TO IDEAL SOLUTION (TOPSIS) FOR SPATIAL DECISION PROBLEMS.”