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Determination of unsuitability points on the route of Van Gölü-Kapıköy railway line by using GIS and AHP method

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ABSTRACT

It is seen that there is a parallelism between the economic power of the countries and the development of the logistics sector of their sustainable competition. According to the free market economy in the Keynesian economic system, the logistics sector has an important function. With the globalization of the world, the logistics sector gains importance and this makes railway logistics gain importance. The development of railways allows the development of the economy. Since it positively affects the cost-benefit analysis of public institutions and organizations and the private sector, the railway route should be chosen in the most appropriate way. In the determination of the route Geographic Information System (GIS) applications are used with the developing technology in recent years. Geographic Information Systems applications, on the other hand, play a major role in collecting data analytically, obtaining results and using the results thanks to computer technologies and software systems. The Analytical Hierarchy Process (AHP) method, which is used together with Geographic Information System (GIS) applications, makes it possible to provide the most appropriate and maximum benefit in line with certain parameters by comparing the alternatives in the decision-making process in the most appropriate way. These parameters considered include slope, aspect, stream, building, small water flow and transportation. Taking these parameters into account, the conditions affecting the railway line were evaluated using the AHP method.

1. Introduction

The importance of logistics has increased in line with the increasing need for raw materials and market needs due to the increasing industrialization activities with the industrial revolution. This has led to the transportation sector gaining importance. In transportation, it has led to the search for alternative ways to ensure that heavy, large-volume loads reach the maximum benefit with the least cost, in accordance with the reliability, economy and efficiency standards. The most suitable of these roads is undoubtedly the railways. The logistics sector has gained momentum with the railways. With the increase in the importance of the railway in logistics, priority was given to railway investments, causing it to gain importance at the national and international level. Railways used in public institutions and organizations and in the private sector maintain their place in the globalizing world and are developing day by day. (Doğan & Ateş, 2019; Erkaya, 2019)

In the study, Analytical Hierarchy Process (AHP) and GIS methods were used to determine the points that are not suitable for the current railway in terms of topographic and settlement angles. Kiema, Dang'ana and Karanja et al. studies in the Kenya-Sudan GIS-based suitability for the rail route selection and analytical hierarchy process (AHP) model of success largely depends on several criteria determined in accordance with points allocated to the integrity of elections, this bolstered with CBS has said that it will provide good results. Here, too, it conveniently shows that GIS is an effective and efficient means of railway transportation. He also stated that it is up to engineers, consultants and environmental experts to implement the studies well (Kiema et al., 2007).

Erkaya stated in her study that other types of transportation are not ideal and economical like railway transportation. In particular, he stated that rail transportation is the best answer to the expected conditions from other transport systems. Mesala has stated that the railway is the most suitable for freight

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logistics. However, he pointed out to us that the railway planning stage is facing difficulties, that in order to eliminate these difficulties and to use this transportation in the most favourable way, the railway line should be modelled with the most appropriate model (Erkaya, 2019).

Panchal & Debbarma, in his work, the parameters of the main effects of topography construction on the railway route located in the rear Shiwalik were taken into account and the acceleration of the current railway route was discussed. Using the AHP direction, a more appropriate route analysis was determined and the criterion that the previous railway plan was not taken into account was determined, and it was determined that the factors in the construction of the topography should be taken into account for a plan. (Panchal & Debbarma, 2011).

Various parameters affecting the feasibility of the railway route will be planned to be transformed in layers using the Geographical information system (GIS). The slope layer can be run from the digital elevation model (DEM) of the workspace. Maps are scanned and imported in ArcGIS 10. Maps will be digitized using linear and polygonal tools by selecting georeferenced. Then the Digitized data will be converted to raster format. The weight value calculated by applying the Analytical Hierarchy Process (AHP) method to all layers prepared in the geographic information system (GIS) environment will be obtained and the consistency ratio will be determined. The layers prepared in the geographic information system (GIS) will be processed with weighted overlay. As the layers are superimposed, maps will be created with the combination of the various layers. The combination of the weight of the layers is called the Feasibility Index. The output map, which is the output of the layer combination, will be based on the feasibility index and the cumulative effect of the factors considered will be shown. Responsibility for the implementation of the principles of interoperability determined by the Ministry for geographic data, geographic data set and geographic data services in order to ensure interoperability and compatibility between the geographic data themes they are responsible for belongs to the relevant institutions and organizations. (Tri Dev et al., 2017)

Geographical information system (GIS) provides maps and analysis opportunities in many sectors such as logistics, distribution and urban planning. Supporting the logistics activities that form the link between the members of the supply chain with Geographical information system (GIS) applications; It provides benefits such as reducing costs, making communication and operations more effective. In addition, logistics enterprises prefer Geographical information system (GIS) applications in their activities, providing competitive advantage; can increase their market share. By using GIS technology in determining the routes in freight transportation, In addition to this; As a result of the logistics enterprises investing in Geographic Information System (GIS) technologies, the possible benefits of these investments to their activities are quickly seen (Çekerol & Nalçakan, 2011).

In our country, the railway route was determined by considering the topographic structure, special location, and the location of the mountains in terms of regions, and thanks to this route, it was used on a national and international scale. The lines used in railway logistics make great contributions to the economy of the country and the region where it passes. Thanks to the railway lines, the country gains economic vitality, a sustainable competitive environment is created and scientific technological innovations are made in the country thanks to the advantages brought by competition (Kalkan & Kalkan, 2016)

2. Method

This section provides information about the study area, the data sets used, and the methods used.

2.1. Study area

In the east of our country, the importance of railways is increasing due to the mountainous topographic structure and being far from the sea. The existing Van Lake- Kapıköy railway route, which is used in freight transportation, is one of our most important lines used in transit trade with the neighbouring country Iran figure 1.

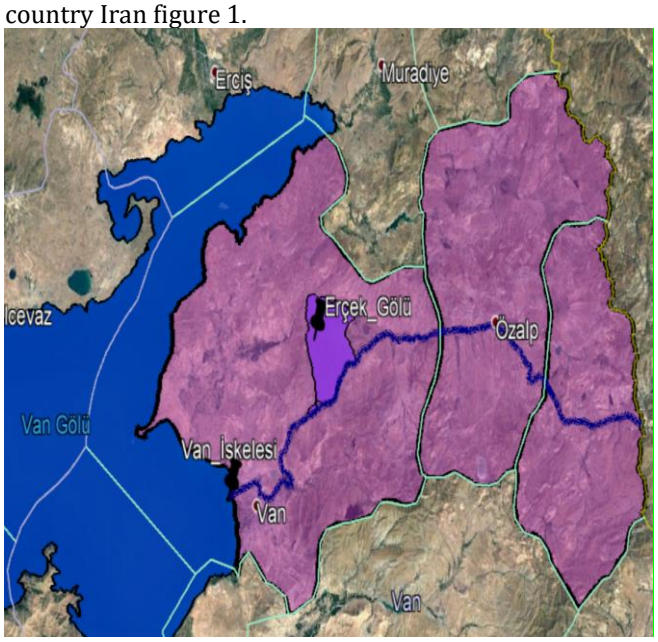

Figure1. Study area of the examined railway line

The Van Lake - Kapıköy line, which is examined in our country, plays an important role in freight transportation to Iran and other countries. The logistics we have chosen provides the development of combined transportation in the centre located on the railway line. The developing economy with the contributions of the railway line increases the economic welfare in the country or in the region. In railway logistics, it maintains its importance in logistics due to the transportation of heavy and costly loads with the most convenient and minimum cost. (Doğan & Ateş, 2019)

With the use of Geographic Information Systems (GIS) in determining the unsuitability points for the current route shown in figure 2 the analysis of analogue maps has started to be used in necessary studies and

feasibility studies using modern computer technologies instead of expensive, inefficient and old techniques. Geographical Information Systems (GIS) usage areas provide great convenience to people working in this field with its use in countries and regional areas around the world. The applications used together with these facilities should be used in an efficient, economical and effective manner in accordance with their purposes. In addition, route planning is a very difficult task in mountainous regions. Route planning is more difficult on the Van Lake- Kapıköy line. Because of the topographical structure of the Van Lake-Kapıköy line, unsuitability points should be determined by considering the risks for logistics transportation such as large rocks falling from the mountains, sloping land, view and stream. (Weiwe & Ye, 2019)

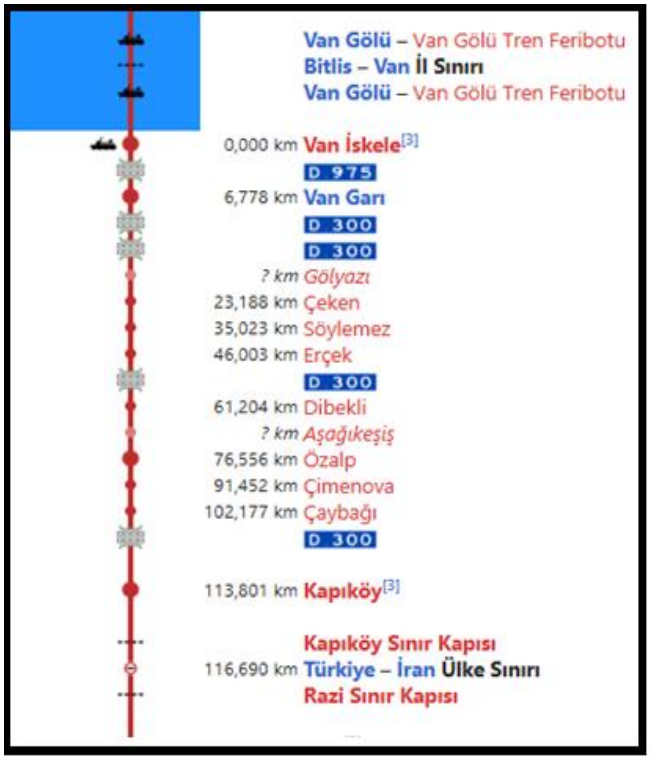

Figure 2. Van Lake–Kapıköy railway village and district names where the route passes

2.2. Data

In order to realize a certain purpose, the parameters suitable for this purpose must be determined in the most rational way. For these reasons, we should choose parameters suitable for our purpose. Necessary studies should be carried out for the modernization of the railway line between Lake Van-Kapıköy. For this purpose, the parameters affecting this line were evaluated first.

In addition, various parameters that affect the alignment of the railway route used for railway logistics will be considered. These analysed parameters are an important factor in determining the unsuitable areas of the logistics route.

The investigated criteria are:

- Slope
- Aspect
- Stream Line
- Transport
- Rivers and water bodies
- Building

The above factors should be investigated and the decisions should be processed and analysed in the most rational way and in the most appropriate GIS-based programs.

2.3. Analytical hierarchy process (AHP)

Analytical Hierarchy Process (AHP) method used in this study. Each criterion was digitized and represented by a layer in the GIS environment. These factors and their sub-criteria are weighted according to the analytic hierarchy process and reclassified layers were applied to obtain the map showing the unsuitability points in region. In practice, the Analytical hierarchy process (AHP) was used to determine the relative importance of each criterion.

If we start with the definition of the Analytical Hierarchy Process (AHP), the Analytical Hierarchy Process is the decision-making process that creates criteria and alternatives and evaluates them in the most appropriate way to achieve the determined purpose. The Analytical Hierarchy process (AHP) includes both rating and comparison methods. Rationality requires developing a reliable hierarchical structure or feedback network that includes necessary and efficient alternative criteria to make the most appropriate choice. Instead of evaluating the necessary norms, alternatives are sometimes compared. Within the framework of these comparisons, the most appropriate consistency range is determined. The purpose of this comparison is to determine the basic criteria and alternatives and to define them in an optimal hierarchical order, to reach the conclusion by comparing the criteria and alternatives with each other. The analytical hierarchy process (AHP) is based on three basic principles. These are the establishment of hierarchies, determination of superiorities, and logical and numerical consistency. Purpose, criteria and alternatives are determined by creating hierarchical stages. (Fan & Qian Xue, 2018; Özdemir et al., 2020)

These stages are linked to all existing parts. It is easy to see how a change in any of them will affect the stage. In decision making, a lot of data is brought together in this way and comparisons can be made between parts that look different. During this phase, the most appropriate choice is made to apply certain criteria. These operations must be logically and numerically consistent. With the help of a nominal clock, the elements that make up the hierarchy are compared in pairs. Comparisons are calculated to create a comparison matrix. Between the mathematical operations and the various elements of the hierarchy is the eigenvector of the matrix. The eigenvector is used to evaluate whether the consistency ratio of the comparative matrix is reasonable. If we consider the analytical hierarchy process for railway logistics, it is a multi-criteria decision-making technique used to find the relative importance of the line's criteria. The criteria to be examined in the unsuitability points map to be

created; slope, aspect, stream, building, rivers/water bodies and transportation map (Fan & Qian Xue, 2018).

Table 1. Reference scale table to be used in the AHP method

Scale	Degree of preference	Explanation
1	equal	The two activities contribute to an equal purpose.
3	Medium	Experience and judgment somewhat favor an above-average efficacy.
5	Strong	Experience and judgment Strongly favor an activity over value.
7	Very strong	Experience and judgment very strongly favor an activity over value.
9	Extreme	An event affects the target to the greatest possible degree.
2,4,6,8	Intermediate value	It is used to present the compromise between 1,3,5,7,9 values.
Opposite	Mutual Opposites	It is used for inverse comparison.

A value from 1 to 9 is used to calculate the relative importance of these criteria. Table 1 shows the recommended reference scale. The preference criteria given in Table 1 are used to compare various parameters.

AHP is evaluated by comparing the consistency ratio calculation with the number of factors present and the baseline coefficient. Explained with the following items;

- After obtaining the pairwise comparison matrix, normalization is performed.
- After normalization, the priority vector is obtained. A consistency test is performed to see if the pairwise comparisons are consistent.
- CR, CI and RI values are used to perform consistency tests.
- RI value changes the number of criteria.

Table 2. Table of numbers of criteria to be used for consistency

Number of Criteria	Random Index Values (RI)
3	0,58
4	0,90
5	1,12
6	1,24
7	1,32
8	1,41
9	1,45
10	1,49
11	1,51
12	1,53
13	1,56
14	1,57
15	1,59

The recommended number of criteria is shown in Table 2. The random index values given in Table 2 are used to compare various parameters.

2.3.1. Process steps of AHP method

- The first step is to define the problem,

It is to determine what we will select and sort for the railway line that is handled with this process step figure 3.

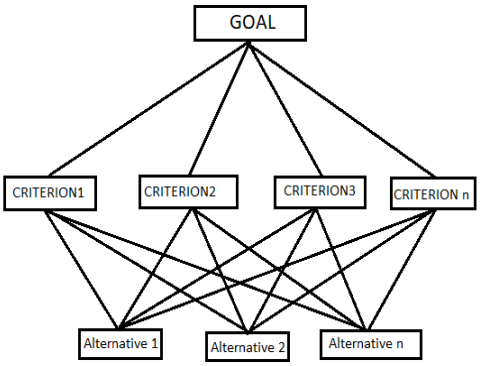

Figure 3. AHP schema

- In the second processing step, the comparison matrix is created,

The comparison matrix is an n*n square matrix. The matrix components on the diagonal of this matrix take values of 1.

Table 3. Alternatives table display

ALTERNATIVES Comparison Matrix by J Criteria				
	A1	A2	…	Am
A1	a11	a12	…	a1m
A2	a21	a22	…	a2m
…	…	…	…	…
Am	Am1	Am2	…	amm

Here;
m: number of alternatives
ai: i alternative i=1,2,3,…,m
aik: importance degree according to i alternative aik=1/aik and aii=1

$$\boldsymbol{A} = \begin{bmatrix} a11 & a12 & \dots & a1n \\ a21 & a22 & \dots & an2 \\ . & . & \dots & . \\ . & . & \dots & . \\ . & . & \dots & . \\ an1 & an2 & \dots & anm \end{bmatrix} \quad (1)$$

- The third process step is to obtain the normalization value, Normalization formula;

$$\text{bij} = \frac{\text{aij}}{\sum_{i=1}^{n} \text{aij}} \quad (2)$$

- The fourth operation is to obtain the priority vector, After the Normalization Operation, the normalized matrix is obtained.

$$C = \begin{bmatrix} c11 & c12 & \dots & c1n \\ c21 & c22 & \dots & c2n \\ . & . & \dots & . \\ . & . & \dots & . \\ . & . & \dots & . \\ cn1 & cn2 & \dots & cnn \end{bmatrix} \quad (3)$$

- The fifth process step is to perform consistency tests,The priority vector is obtained as follows.

$$w_i = \frac{\sum_{j=1}^{n} c_{ij}}{n} \quad (4)$$

- The sixth process step is the selection or sorting process.

Consistency Tests

In order to perform consistency tests;

- Concordance index (CI)
- Random Index (RI)
- Concordance rate (CR)
- Values are needed.

$$CR = \frac{\text{CI}}{\text{RI}} \quad (5)$$

It is calculated with the formula.

If the calculated CR value is less than 0.10, it indicates that the comparisons made by the decision maker are consistent. A CR value greater than 0.10 indicates either a computational error or inconsistency in the decision-maker's responses to the comparison matrix. The fit index formula is as follows.

$$CI = \frac{\lambda\text{max}-n}{n-1} \quad (6)$$

n: Number of Observations
λmax: Basic Eigenvalue

Where; the λ value is calculated as follows;

First of all, D column vector is obtained from matrix multiplication of A comparison matrix and W priority vector.

$$D = \begin{bmatrix} a11 & a12 & \dots & a1n \\ a21 & a22 & \dots & a2n \\ . & . & . & . \\ . & . & . & . \\ . & . & . & . \\ an1 & an2 & \dots & ann \end{bmatrix} \times \begin{bmatrix} w1 \\ w2 \\ . \\ . \\ . \\ wn \end{bmatrix} \quad (7)$$

Then, by dividing the reciprocal elements in the column vector [D] and the column vector [CW], the matrix [E] of the base values of each evaluation factor is obtained.

$$Ei = \frac{Di}{Wi} \quad (8)$$

$$\lambda = \frac{\sum_{i=1}^{n} Ei}{n} \quad (9)$$

Finally, the basic value coefficient is calculated by taking the arithmetic average of the items in the [E] matrix. We will obtain land with the help of these formulas.

3. Results

3.1. AHP results

First, the criteria covering the study area were determined. The criteria handled by this process step is to determine that we will select and sort for the railway line. Selected criteria; earthquake, flood, rockfall, avalanche and landslide factors. Comparison matrix is made between these selected criteria and since there are six criteria, a 6*6 square matrix is obtained. Matrix components on the diagonal of this matrix take the values of 1, since no criteria are superior to itself.

After the comparison matrix obtained in figure (3), the normalization value in figure (4) is obtained as the third processing step. In order to obtain this normalization table, Total (t) and Criterion weight (c) are calculated in the comparison method in the first tableThe fifth processing step is calculated with the formula CR=CI/RI in figure (6) to perform the consistency test.

With the help of the values in the Normalization table in figure (4), the priority vector and normalization process are performed and the consistency process will be performed in the province.

It is first calculated with the formula $CI = \frac{\lambda\text{max}-n}{n-1}$.

“n” (number of observations) is subtracted from the value of λ_{max} (6,428656393) obtained in Table (3.2.4.).

λ_{max} -n=6,428656393-6 = 0,428656393 …….1.

n-1=6-1=5 ……2.

$CI = \frac{\lambda\text{max}-n}{n-1} = \frac{0,428656393}{5}$ = 0,085731279

By using the Table of Criteria Numbers to be Used for Consistency in Table (2.1.2.), the "RI" (Random Index Values) value is selected in accordance with our criterion number value. Since the number of criteria is 5, Random Index Values (RI) are taken as 1.252 in Table (2.1.2.).

$CR = \frac{\text{CI}}{\text{RI}} = \frac{0.085731279}{1.252}$=0.068475462……..result

By using the Analytical Hierarchy Analysis method, which is a multi-criteria decision-making technique used to find the relative importance of the criteria, it is assigned to criteria such as earthquake, flood, rockfall, avalanche and landslide, and the final weight is found by relative comparison. The solution is then checked for consistency. If found consistent, the calculated weights can be assigned to each criterion and sub-criteria.

Consistency ratio (CR) consistency of solution;

✓ The parameters are considered appropriate if the CR value is < 10%. It is suitable and usable for analysis.

✓ If the CR value is > 10%, the parameters are not suitable.

Therefore, preferences are reviewed to obtain a consistency result. The CR (Consistency Ratio) value was found to be 0.068475462 as a result of the transactions. The CR value is 0.07 rounded off. Since the Consistency Ratio is 07% < 10%, the result obtained according to the consistency of the solution; The parameters selected and considered suitable for analysis can be used.

Table 4. Criteria of parameter

	S	A	SL	B	WB	T	W (c)
S	1	7	5	4	9	9	0,50
A	1/7	1	2	2	3	5	0,16
SL	1/5	1/2	1	3	5	7	0,18
B	1/4	1/2	1/3	1	2	3	0,09
WB	1/9	1/3	1/5	1/2	1	2	0,05
T	1/9	1/5	1/7	1/3	0,5	1	0,03

S: Slope, A: Aspect, SL: Stream Line, B: Buildings, WB: Water Bodies, T: Transport

3.2. Standardization of sub-criteria layers for unsuitability points

Many criteria are not suitable for this line on the route that the railway has passed. The influence of each factor on its alignment is outlined below "Fig. 4".

3.2.1. Slope

The slope factor is the ratio of the horizontal distance between two points to the difference in elevation. The difference in height between two points at a certain horizontal distance is specified as the slope. The fact that the existing line in the study area is located in a mountainous region necessitates the selection of the lowest slope and the most appropriate slope of the line selected for the route. The slope layer can be run from the digital elevation model (DEM) of the workspace. slope factor; It is classified into 7 groups as flat, almost flat, slightly sloping, moderately sloping, steeply sloping, very steeply sloping, steep sloping, very steep sloping.

The slope of the land is considered very critical on the railway route because it directly affects the railway route. The proposed railway line should not pass through areas with high slopes. The high slope in railway transportation increases energy consumption, reduces speed, and makes it difficult for wagons to carry freight. If the slope in the study area is more than 25 degrees, it increases the cost of the project as the probability of landslides close to the railway track increases. The slope layer of the study area is shown in figure 4.

Table 5. Classification of slope factor

Categories	Range	Rating
Flat	0-5	1
Slightly Sloping	5,1-10	2
Medium Slope	10,1-15	3
Steep Slope	15,1-20	4
Very Steep Slope	20,1-25	5
Steep Slope	25,1-30	7
Very Steep Slope	30,1-76,4	9

3.2.2. Aspect

In mountainous areas, the direction of view of a slope or a surface is a situation that determines its position against the sun's rays, south or north, and determines the resulting natural conditions. The aspect factor is very important for the railway passing in mountainous regions. Because the snow masses formed in snowfall turn into avalanches and the sun rays coming from the view cause an avalanche, which is a natural disaster, which causes an accident and leads to the closure of the line figure 4.

Table 6. Classification of aspect factor

Categories	Range	Rating
Flat	(-1)	0
North	(0°- 22.5°)-(337.5°- 360°)	9
Northeast	(22.5° - 67.5°)	7
East	(67.5° - 112.5°)	5
South East	(112.5° - 157.5°)	2
South	(157.5° - 202.5°)	0
South West	(202.5° - 247.5°)	1
West	(247.5° - 292.5°)	3
Northwest	(292.5° - 337.5°)	4

3.2.3. Stream and accumulation line

In some of the waters flowing on the soil surface, the flow is such that it covers the entire surface like a cover. It covers the incoming waters in small lines. Streams are formed when water collects and flows along a certain line. Being in small lines shows the branching of the waters and the presence of small water flows on the railway line causes deformation on the rails at the bottom figure 4.

Table 7. Classification of stream water flow factor,

Range	Rating
1-4	0
5-6	1
7-9	5
10-11	7
+11	9

3.2.4. Transport

The existing rail line should be close to major cities or villages due to accessibility concerns. Thus, it reduces the cost of the railway. The transportation of the study area is an important factor affecting the route planning process. If the railway facility is too far from important places, it will be difficult to use "Fig. 4".

Table 8. Classification of transport factor

Range	Rating
0-100	0
101-200	1
201-300	3
301-400	5
401-500	7

3.2.5. River and other water bodies

The river and water bodies flows continuously or at regular intervals in the direction of the slope of the earth in a certain place on the earth and underground. Rivers appear as the most important external factor in shaping the geography we live in, beyond just meeting the needs of people for agriculture and energy.

Streams shape the earth by erosion and deposition. Due to this important feature, it plays an important role in the places where the railway passes. This factor causes landslides and floods in a negative role in the railway. This can lead to major disruptions and accidents in rail transport figure 4.

Table 9. Classification of water bodies factor

Range	Rating
….	7
…	9

3.2.6. Building

An important part of his research in railway transport is not only to ensure the safety of passengers or the convenience of freight transport, but also to protect the people living in the railway vicinity from disturbing and damaging vibrations in buildings and to reduce these vibrations "Fig. 4".

Table 10. Classification of Building Factor

Range	Rating
	0
	5
	9

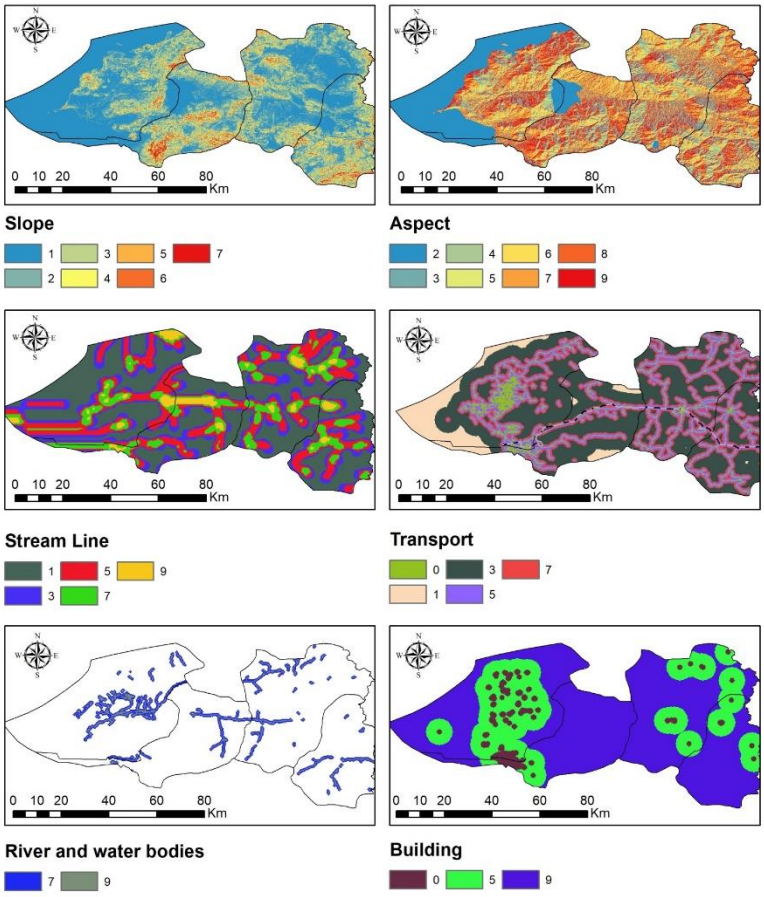

Figure 4. Slope(a), Aspect(b), Stream Line (c), Transport(d), River and water bodies (e), Building(f) criteria maps of the Study Area.

3.3. Result map

It has been taken into consideration that the existing railway route is important for the line in the region and is the basis of many disasters and that it is important in the examination of the criteria that these disasters adversely affect the railway transport. These considered parameters were examined in 6 classes as slope, aspect, stream, building, rivers and water bodies, transportation, and these criteria were processed in ArcGIS 10 program, superimposed, and processed with the criterion weights found in the Analytical Hierarchy Process (AHP) method, as shown in figure 5. Unsuitability points on the existing railway route have been identified.

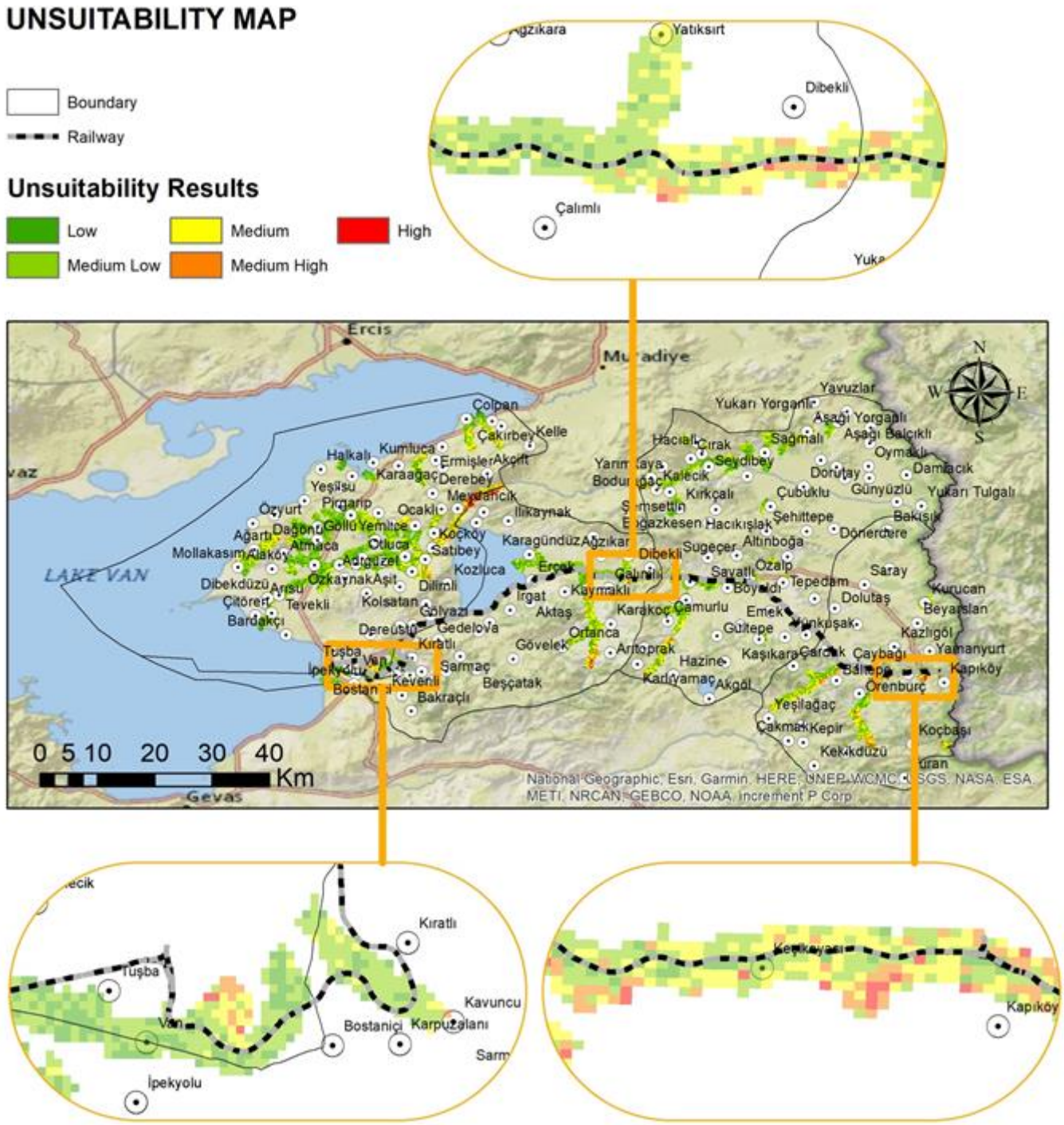

Figure 5. Unsuitability points on the railway route.

4. Discussion

Due to the location of the Van region, the elevation is very high and the topographical structure is covered with mountains, which has caused it to be a mountainous region, and also negatively affects the transportation sector in many ways because it is exposed to continental climatic conditions. In order to eliminate these disadvantages, natural conditions should not affect transportation. This, in turn, reveals the need to organize and structure the transport sector in a good way. As a result of the dec deconstruction of the necessary R&D studies, the necessary needs were not met by ignoring the natural factors that negatively affect the railway transportation. The existing railway route created as a result of ignoring these needs decays the rail geometry and causes wear on the balances. Due to the fact that it negatively affects railway transportation, it causes economic losses to people and institutions interacting with the railway. As a result of the natural disasters caused by the effects of these criteria on the distorted urbanization of the region, disruption of transportation and social and cultural destruction of the region and deformation of the line caused disruption of railway logistics. This, in turn, leads to the formation of financial losses in the country's economy. in order to eliminate this damage, it is necessary to study the criteria that should be considered. In this study, these criteria were examined and maps of the criteria were obtained. In these maps obtained, the highest risk areas were identified and inappropriate lines were identified and it was stated that this study should be taken into account in order to identify and prevent any material and moral losses caused by these inappropriate lines in advance.

5. Conclusion

In this article, the development of the railway, its importance, its indispensability for the world and our country, and its contributions to the logistics sector are emphasized. It has been mentioned that the necessary studies should be carried out for the efficient and effective use of the railway together with the globalization in the world and appropriate investments should be made to carry out these studies. The contribution of the railway in the country's economy and its importance for sustainable competition focuses on its economic and social contributions. It is emphasized how the railway line should be selected and how to choose this selection in the most appropriate way, and the computer systems and technology used in this selection, as well as the Geographic Information Systems (GIS) applications implemented together with the technology are mentioned.

In addition, the importance and place of the selected Van Lake- Kapıköy railway logistics line in the country's economy is mentioned. It is a mountainous region due to the location of the current route. For this reason, it is in a position open to disasters. This shows that the cost of the route is high and it is a risky factor. Efficiency, efficiency, economy, workability, standardization and similar advantages of Geographical Information Systems (GIS) applications are mentioned. The analysis of the risky areas on the route should be done in order not to disrupt the economic and logistics of the route used for freight transportation as a result of any negative effects of the criteria discussed as a result of the Geographical Information Systems (GIS) based examinations of the existing railway route that we discussed in this study. The criteria used as main data will be factors such as slope, aspect, stream, building, small water flow and transportation

The data sets of these factors were processed in the Geographic Information Systems (GIS) environment and as a result of the processing, certain values were given in line with the Analytical Hierarchy Process (AHP) method, which we applied, and these values were passed in the required processing stage of the method and the weights and normalized values of each criteria were calculated. Then, the values obtained as a result of the calculation were subjected to the consistency index and their suitability was examined. The suitability of the consistency index has been determined and appropriate, and a better and more useful line proposal of the railway line used for freight transport should be used for preliminary route planning and will be more useful. With the use of Geographic Information Systems (GIS) application, it is emphasized to provide maximum benefit and minimum cost. The unsuitability points on the route were determined by collecting, analysing, processing and reporting the most appropriate data as a result of the comparisons made based on the criteria selected in the Analytical hierarchy process method applied within the scope of Geographic Information Systems applications. In addition, the most appropriate use of the data obtained in line with these reports is mentioned.

Author Contributions

The contributions of the authors of this article is equal.

Statement of Conflicts of Interest

There is no conflict of interest between the authors.

Statement of Research and Publication Ethics

Research and publication ethics were complied with in the study.

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