Investigation of Pedestrian Accessibility to Schools; A case study of Rize

Sabire Edanur Mamat*1 , Aziz Şişman2

1Ondokuz Mayıs University, Graduate Education Institute, Department of Geomatics Engineering, Samsun, Turkey
2Ondokuz Mayıs University, Faculty of Engineering, Geomatics Engineering, Samsun, Turkey

Keywords	ABSTRACT
Accessibility School Network Analysis	Geographic Information Systems (GIS) which we frequently use in many areas today, with the capabilities of spatial analysis and query we can access information that will enable us to make the right decision in a shorter time. The rapid population growth experienced with the rapid development of cities brought many problems with it. Nowadays GIS is used the solutions of spatial problems such as transportation and infrastructure services. In this study, pedestrian access of the schools was examined in the Merkez districts of Rize. The accessibility of primary schools, secondary schools and high schools within the study area was examined and access maps were created in 5 min and 10 min time zones depending on the average pedestrian speed. In the Merkez district, schools were seen to be more density in neighbourhoods close to the coastal area. It was observed that, pedestrian access was sufficient in these parts, but it has been observed that the access was not sufficient because of the decrease in the number of schools towards the inner parts. In addition, the access problem in high schools is more than secondary and primary schools. Public transport or shuttle service is used where pedestrian access is not sufficient.

1. INTRODUCTION

The city can be defined as the place where people who have a common cultural and economic cooperation gather (Göney 2017).

Migration from rural to urban has accelerated with the industry developing in the city and its surroundings. The number of people working in the industrial sector has increased rapidly with the development of the industry in many settlements that previously had a high population of trade (Sezer et al. 2018). Population growth has led to the emergence of more diverse functions in cities. While previously only the industry was the majority, the service sector has started to develop in later (Çelikyay 2013).

With the rapid increase population of the citiessmart applications have been tried using developing technology in order to find solutions to problems such as transportation, health, safety and environment (Örselli et al 2019). Smart cities where a constant flow of data is provided about the physiological and sociological status of that place, and by combining and synthesizing these interconnected data for a common purpose, they are cities where the quality of life is increased(Batty et al. 2019).Smart cities have become more popular over the past 20 years. Most of the methods of being smart cannot be obtained in a short time, they can be implemented with longer time and stability (Örselli et al 2019). In order to call a settlement a city, attention should be paid to its urban functions (Tümertekin 1973). Functions are used to determine the boundaries of the city as well as to show urban characters. The development of educational activities and functions is one of the most important features of that city (Çetin 2007). The content and accessibility of education should be given to all people on equal terms. Governments are trying to develop various methods in order to provide equal opportunity to their citizens (Sezer et al. 2018).

Geographic Information Systems (GIS) can be used in many areas which related to the spatial data, such as settlement, health, transport, education etc. The studies of GIS in the field of education are supported with examples such as locations, accessibility and distribution of schools.

In the current study, the accessibility of the children to the schools in the Central District of Rize. It was conducted with the network analysis in the neighborhoods of the Central district of Rize province. The study is also aimed to be a guide in determining suitable and unsuitable places in terms of access to schools.

2. METHOD

This study carried an analysis of the children access to primary, secondary and high schools on foot is put forward, in Rize Central district

Study based on network analysis and ArcGIS software was used. Road network data and neighbourhood maps were obtained from Rize Municipality. Population data were obtained from Turkish Statistical Institute and location data of schools were obtained with the help of Google earth.

The road network data set was created in the analysis. On this dataset, the average pedestrian speed of children is 1.1 m/s, and the adult pedestrian speed is 1.4 m/s (TSE ts12174 standards). In the light of these data, it was analysed how much areas the schools could reach in 5 minutes and 10 minutes.

Figure 1. The road network of the study area and the location of the schools

2.1. Location and Features of the Research Area

Rize province is located in the Eastern Black Sea and is adjacent to the provinces of Trabzon, Artvin, Bayburt, Erzurum and has a coast to the Black Sea.

The total area of the city is approximately 3921 km², which is 5% of Turkey's territory. It is the smallest province in the eastern Black Sea provinces after Bayburt and ranked 72nd in terms of acreage in all of Turkey (Turkish Statistical Institute 2013).

The research area includes the neighbourhoods of Central district of Rize. The population of the province is 343,212 according to 2019 Turkish Statistical Institute data and the population of the Central District is 147,411 according to 2019 Turkish Statistical Institute data.

Besides tea production in Rize province, where 98.7% of the agricultural land consists of tea gardens, kiwi and hazelnut are among the other agricultural products (Rize Food Agriculture and Livestock Provincial Directorate Data, 2014).
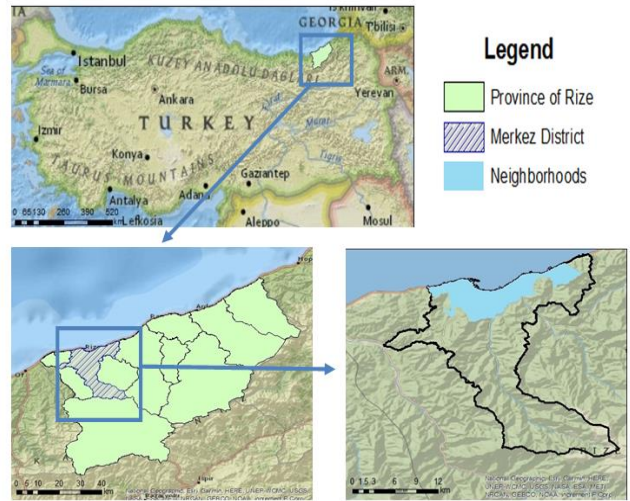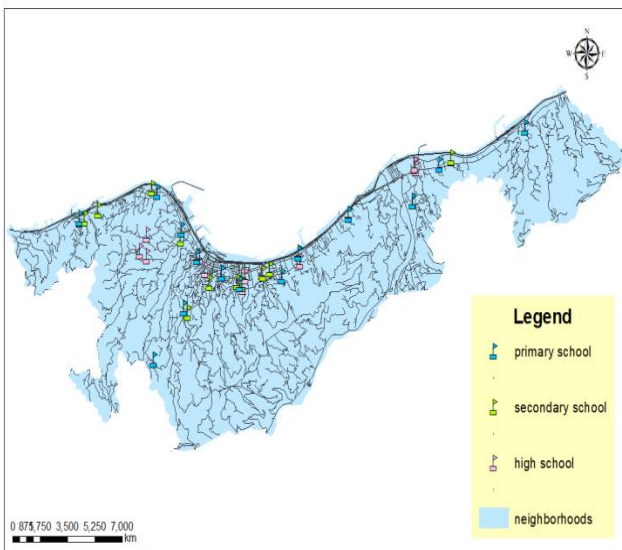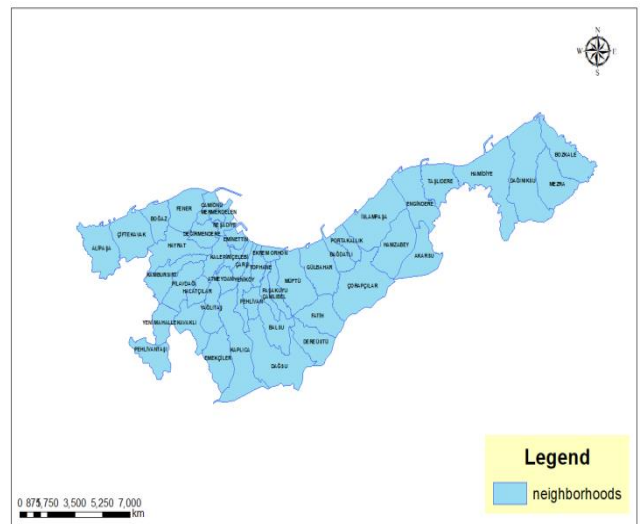

Figure 2. Location map of the study area

Figure 3. Central district's neighbourhoods

3. RESULTS

In the analysis, it was tried to reveal how sufficient the pedestrian access of primary, secondary and high schools is. It has been determined that the total number of primary schools is 14, the number of secondary schools is 19 and the number of high schools is 17 in the neighbourhoods in the Central district.

According to the population density map (Figure 4) of the central neighbourhoods, it was seen that the density is high towards the middle of the study area and in the neighbourhoods close to the sea. And also, it was seen that more schools were located in areas where the population density was high. It can be concluded that the population density and the distribution of schools increase and decrease in direct proportion to each other.
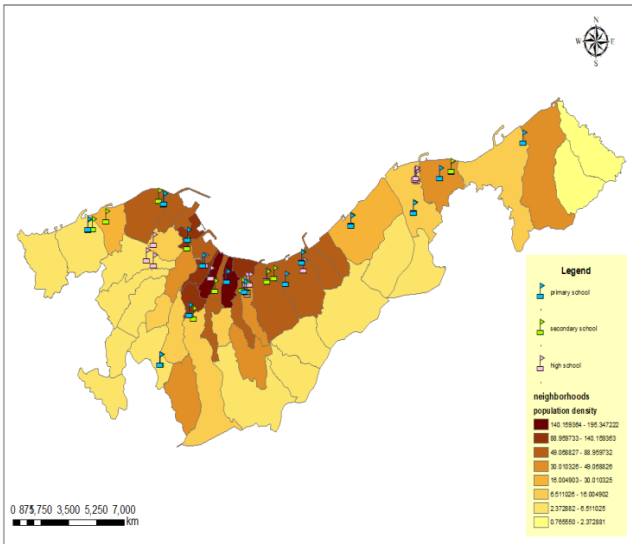
Figure 4. Population density of neighbourhoods and distribution map of schools

Figure 5. Accessibility to primary schools for children

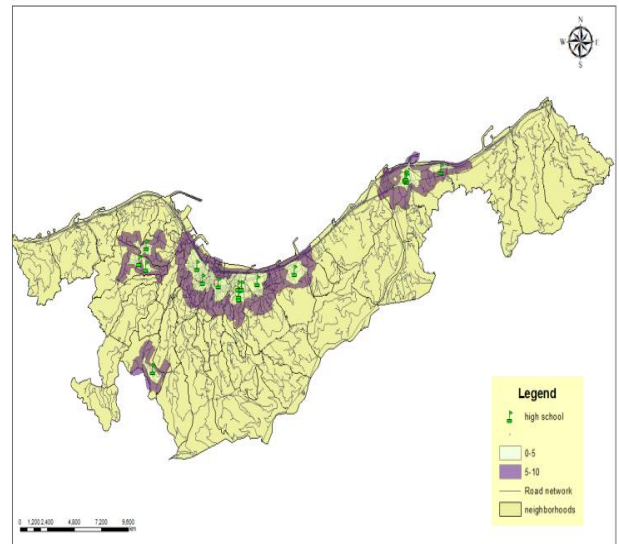**Figure 6.** Accessibility to secondary schools for children

Figure 7. Accessibility to high schools for young

In the study area, the accessibility analysis of children in primary and secondary schools based on 5 min and 10 min time with a speed of 1.1 m/s showed that access to primary schools was 19.8% (Figure 5) of the total neighbourhood face measurement and access to secondary schools was 27.2% (Figure 6) of the total neighbourhood face measurement. In the same way, the accessibility analysis of adults based on 5 min and 10 min time at 1.4 m/s in high schools concluded that the reach of high schools was 38.2%(Figure 7) of the total neighbourhood facial measurement.
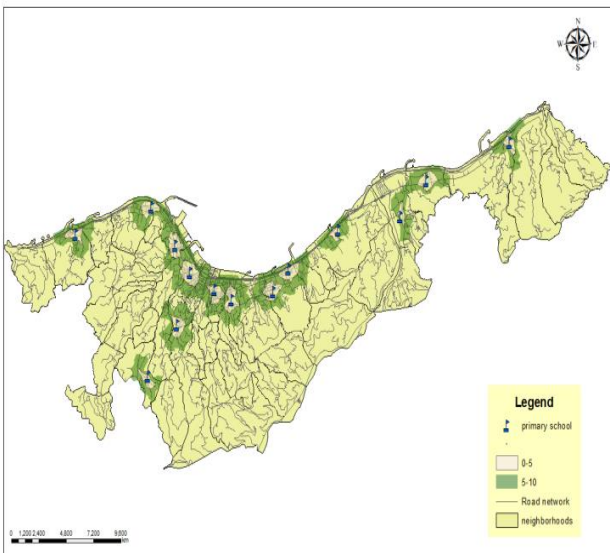
4. DISCUSSION

In the current study according to the access maps, it was seen that accessibility was sufficient in the districts of Çarşı, Yeniköy, Tophane, Atmeydanı, Piriçelebi and Mermerdelen neighbourhoods to primary schools, secondary schools and high schools. At the same time, it was seen that the neighbourhoods with high density are parallel to the coastline, and the density decreases as one goes further inland. The mountainous and rugged terrain of Rize province can be said as a reason for this. Due to the lack of schools in some of the neighbourhoods with medium and low populations, children and adults have never been included in pedestrian access distances. There were problems in access to schools in these neighbourhoods.
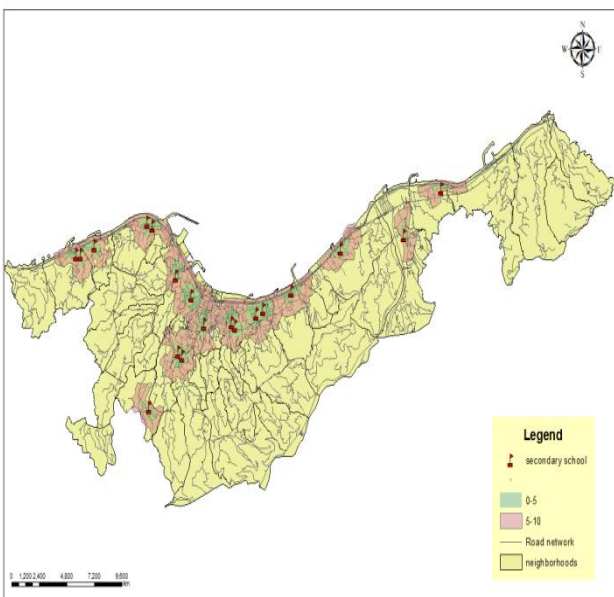
5. CONCLUSION

The decrease in the number of schools in the neighbourhoods away from the coast has required the use of public transport or shuttle transport.

According to the results of the analysis, it can be said that the numbers of primary and high schools in Central district neighbourhoods were insufficient since they have less access than secondary schools. The fact that there were no schools in the southern neighbourhoods and that they were not within the calculated access areas show that the service transportation is more common in these neighbourhoods.

It can be said that shuttle transportation can be more dangerous in the city where transportation is difficult due to the land structure. Increased travel distance can increase the risk of accidents. Based on the principle of equal opportunity in education, not everyone can go to schools under equal conditions creates an important problem.

In the analysis, we also saw the effect of the education function on the population density of the city. Increasing the number of schools and the diversity of locations may be effective in a more balanced distribution of the population.

As a result, the Central district neighbourhoods seem quite trouble in terms of access to schools, except for some well-located neighbourhoods. As a solution; It may be considered to increase the number of schools in the southern part of the region within 5 and 10 minutes walking distance.

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