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## School Route Mapping in Semarang

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# School Route Mapping in Semarang

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**Abstract.** This paper aims to examine some routes for children going to school, so the route can lead their parents to choose a travel mode for their children to go to school. The methods used in this research is GIS mapping and spatial distribution analysis. This mapping route refers to parents where parents usually take their children to school to be dominant, even for distance to the school less than 1 km. This mapping attempts to promote walking and cycling to school for children based on the concentration of the location of the student's residence with a range of distance from the school location less than 1000 meters or more than 1000 meters. Therefore, the mapping process can help the parents to make a decision for transportation modal choice.

**Keywords:** Route mapping, school, transportation modal, GIS.

## 1. Introduction

Increased urban activity is caused by urbanization; according to Kantsebovskaya [1] urbanization is a multi sectoral phenomenon or process, both in terms of cause and effect. Urbanization can also be interpreted as urban population growth [2]. Therefore the increase in population will also increase its urban activities. The growth of urban areas not only develops at the city centre, but will continue to affect the surrounding area and even urban suburbs. This will result in the movement from the urban suburbs to the city centre or otherwise, in order to meet daily needs. The movement from one place to another urban population has been mobilized. Mobilization is defined as a person's ability to move freely, easily and regularly, has a purpose to meet the life needs of his activities [3]. One of them is the activity of students traveling to school, which is one of the activities in urban areas classified as very high and routinely carried out every day, in addition to going to work [4].

According to Vovsha P and Petersen E [5] who conducted research related to the choice of mode to travel found that it turns out that children are active agents in the decision-making process and the development of modal choices for travel distribution. This has led to some developing countries, including Indonesia, school activities being one of the causes of inefficient use of vehicles. School-age children also have regular movements which take place every day and at certain hours. In general, the movement of school students is also classified as not as dynamic as the movement of adults or like a worker. Semarang city is the capital of Central Java province which apparently has been progressing quite rapidly in terms of urban development and infrastructure. Semarang city began



to develop from the centre to the suburbs which were dominated by many high-rise buildings, also categorized into two areas namely the city centre and suburbs.

This is closely related to the distribution of facilities in the central and peripheral areas which will affect the pattern of transportation movements. Activities education is one aspect that contributes to improving the movement of transport. One example is educational facilities for elementary schools in the city of Semarang. Based on the analysis of data from Statistic Bureau in Figures 2002-2014 shows in the city centre population growth has decreased, while in suburbs has increased approximately reached 39,000 inhabitants. Population growth that occurred in the suburbs was not followed by the addition of adequate elementary school facilities. Meanwhile, if the terms of level of service, service facilities elementary schools in the central region is still relatively better than the suburbs. This indicates that the majority of elementary school age residents from the suburbs choose to go to school in the city centre. Such conditions cause more and more vehicle movements from the periphery to the city centre or even vice versa.

## **2. Spatial aspects related to travel behavior**

Spatial aspects related to travel behavior show their relation to spatial aspects. The spatial aspect that is often associated with travel behavior is about land use patterns and city forms. City design can affect travel behavior, if a city is well organized, the availability of pedestrian and low air pollution will tend to travel by bicycle or even on foot. Another study also shows that the location of housing and the distance to the city centre will affect travel behaviour [6–8]. There is a relationship of travel behaviour can be shown through the relationship of the city structure, social and economic conditions of a person, accessibility to a destination and other things that arise from within a person can influence his decision to make movements). In general there 5 main aspects that influence travel behaviour, namely; social environment; individual resources; individual motives; distance to various activities; transportation infrastructure [6,9].

## **3. The relationship between distance and facilities**

An activity-based approach based on opinion [10–12] offers a conceptual framework. Objectives are usually facilities visited in order to carry out activities such as workplaces, shops, schools, public offices or restaurants. According to them, almost all travel activities come from needs or want to carry out other activities those are stationary or unchanging. Daily life is considered as a sequence of activities carried out by individuals in different places for 24 hours day and night. Activities carried out to meet physiological needs (eating, sleeping), institutional needs (work, education), personal obligations (children, shopping) and personal preferences (recreational activities) [12]. The community will prefer facilities that are close to their daily destinations. For example, if you want to send something, it will be easier to use a post office close to the workplace compared to a post office that is close to a place of residence which means that once you make a move you can do 2 activities. As an example, the goal is the workplace, the activity is to send goods and facilities are workplaces and post offices. Movement carried out at a shorter distance and time using a private car is found in the city center at work, shops and other facilities.

There are several reasons for the concentration of this movement, such as a geographer from Germany, Walter Christaller (1933/1966) put forward the theory of central location. The city center becomes the center of the community workplace from the suburbs, shopping centers and also the center of transportation facilities so that it has a high appeal. Concentration of facilities in urban areas also increases the likelihood for visitors to carry out several activities within a smaller geographical area and by itself increases the competitiveness of urban centers as retail locations and other services [13]. However, residents do not visit the city center only for functional reasons. The city center is also a number of recreational and entertainment activities [14]. Movement without using a vehicle will be higher by people who live in the city center because the number of trips that are accessed with a short

distance to more service centers. Some debates also draw attention to the fact that cities that have grid-shaped roads provide higher local scale connectivity [15].

#### 4. Methodology

This study is used data and information were mainly from field observation using questionnaires, interviews and document reviews [16]. In this study, there are two stages of analytical techniques, namely analysis of range service of elementary school locations and analysis of alternative routes to school. The following below explains the analysis techniques used as follows:

##### 4.1 Analysis of range service of elementary school locations

The method used to determine the range of school location services to residential areas using buffer techniques. Buffer is an approach that is done through modeling SIG aims to look at the intersection or connection between the range of a service facility by providing the desired limit or range. Based on SNI 03-1733-2004 "Tata Cara Perencanaan Lingkungan Perumahan", the range of primary school services is 1,000 meters. In this study, the range of school services that will be identified can be divided into 5 parts; 200 meters range, 400 meters range, 600 meters range, 800 meters range, 1,000 meters range and range > 1,000 meters. This analysis aims to determine the location of the student's residence with the range of school facilities to be identified.



##### 4.2 Analysis of route go to school

The next analysis is the analysis of the route to school based on the concentration of student residence and the range of school services that are closest to school. The analysis technique to do the network analysis the selected group's location adjacent student residence and has a range of services within the school less than 500 meters to 1000 meters. Then the location of the student's residence that has been grouped will be identified as an alternative route where the student's residence will go to school by using route analysis techniques in network analysis. Route analysis is a method used to determine the optimal route between two or more objects connected by a road network. In this study the object that is connected is the location of the school and the location of the student's residence.

#### 5. Location of Elementary School

The research location is located in the city center (elementary school or SD 01 Rejosari) and suburbs (elementary school or SD 02 Sendangmulyo). The choice of school location is based on the number of students who register the most in both locations, which is obtained from the new student admission data in 2017 Semarang City Education Office (Dinas Pendidikan Kota Semarang). In addition, the data obtained from the residence of the students then analyzed by the service coverage area elementary school (SD) as far as < 1000 meters and > 1000 meters. Environmental conditions around the location of the selected schools both located in the center or outskirts of the city will be a consideration for students and parents. The overview of school environmen is illustrated in Table 1.

**Table 1.** Description of School Location

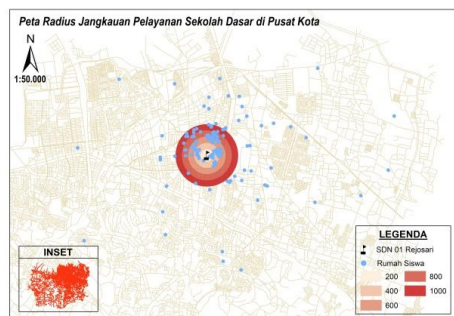
	Street Network ● Elementary School (SD)	Elementary School	Built Environment around the school
SD 01 Rejosari (in the city center)			SD 01 Rejosari is located in a residential neighborhood along the Dr. Cipto road corridor which is the main access from the North to South (Rejosari-Tembalang). The distance between the school location and the main road is about 300 meters. There is no adequate pedestrian path around the area.

	Street Network ● Elementary School (SD)	Elementary School	Built Environment around the school
SD 02 Sendangmulyo (in the suburbs)			SD 02 Sendangmulyo is located in neighborhood street or in residential area. There is no adequate pedestrian path around the area.

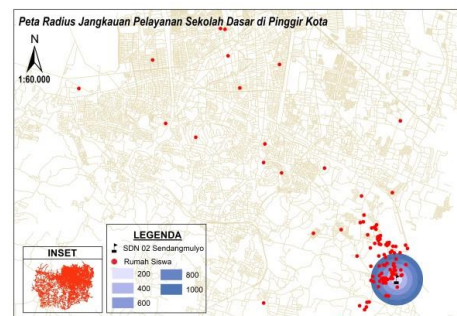
Source: Semarang, 2018

## 6. Range Service of Elementary School

Travel distance that must be taken by students every day to go to school is certainly a consideration for students and parents in making decisions. Both students and parents will consider how they can travel the distance that separates homes where they live to school more easily, quickly and safely. The following Figure 1 and Figure 2 are a description of the location of the school on the location of student residence in the range of 200 meters to > 1000 meters.



**Figure 1.** Range of Elementary School Services in the City Center

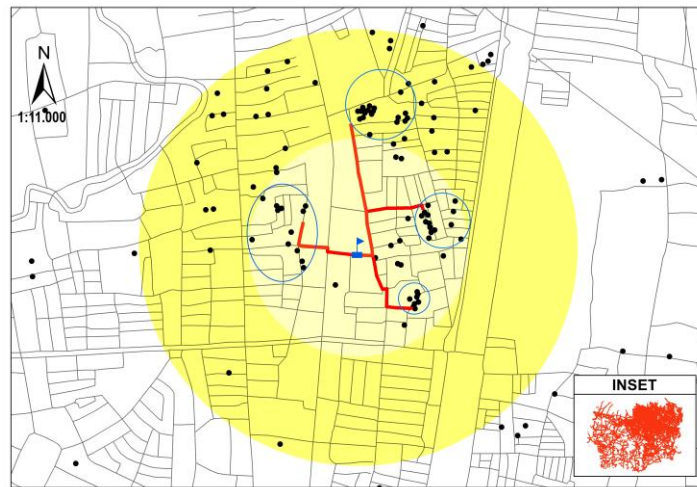


**Figure 2.** Range of Elementary School Services in the Suburbs

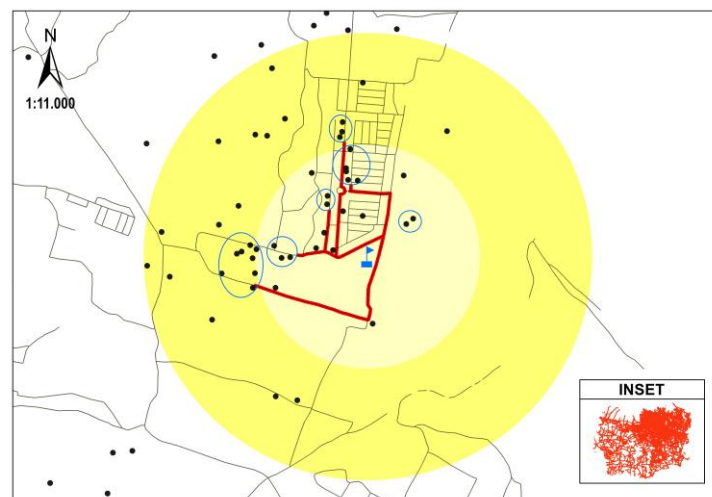
Travel patterns of elementary school students in the central area and the outskirts of Semarang City are travel patterns that are classified as external-internal. This pattern of travel originated from the movement towards the two primary schools, not only from around the school service range (within a range of <1000 meters) but also from outside the service range (in the range > 1000 meters). This elementary school student's travel pattern can be seen in Figure 1 and Figure 2 which is a description of the location of the student's residence on the school location. Travel to elementary schools in the downtown area of movement that comes from external (in the range > 1000 meters) that is equal to 15%, while in the suburban areas that come from external that is equal to 44%. Travel to elementary schools in the downtown area of movement originating from internal (within a range of <1000 meters) that is equal to 85%, while in suburban areas that originate from the internal that is equal to 56%.

## 7. Elementary School Route Mapping

Based on the analysis of the route to school for elementary school 01 rejosari can be grouped into 2 parts, namely within the range of <500 meters and > 500 meters. At a range of <500 meters there are 3 routes, while within a range of 500 meters there is 1 route. (see Figure3).



**Figure 3.** Route school mapping in the city centre (SD 01 Rejosari)



**Figure 4.** Route school mapping in the suburbs (SD 02 Sendangmulyo)

Based on the analysis of the route to school for elementary school in the suburbs (SD 02 Sendangmulyo) can be grouped into 2 parts, namely within the range of  $< 500$  meters and  $> 500$  meters. At a range of  $< 500$  meters there are 2 routes, while within a range of  $> 500$  meters there is 2 route. (see Figure 4).

## 8. Conclusions

Based on the results of the analysis, it is known that with a wide distribution of travel patterns and trips that are routinely carried out every day elementary school students both at the center and the suburbs will indirectly affect city travel. Regular movement of students to school need to be supported their good pedestrian facilities around the school. To support the provision of good pedestrian facilities in the school environment, it is necessary to determine the route to school. Determining the route to school is determined based on the concentration of the location of the student's residence with a range of distance from the school location less than 1 kilometer is expected to increase the pattern of student travel to school using walking or cycling.



## 9. Acknowledgements

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