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Mapping Between Bus Rapid Transit Shelter and High School Location in Semarang

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Abstract: The main users of public bus transport are those who have the goal to work and attend school. But the last few years there has been a decline in the use of public transport for high school students. Partly of the reason are the high use of motorcycle by student and lack of bus stop service range to high school location. This research has aim to increase the use of public transport for school students by mapping Bus Rapid Transit (BRT) shelter and school locations. The research method used are descriptive quantitative with GIs analysis tools and using spatial analysis approach

Keywords: preservation, tourism, educational religious, Kauman

1. Introduction

Transportation is an attempt to move, transport or divert an object from one place to another, where elsewhere this object is more useful or can be useful for a particular purpose [1]. Transportation will grow as the activity grows. The wider the area to be serviced, the more transportable the movement will be. Increasingly urban dwellers lead to higher activity and the number of trips of both people and goods. Problems such as congestion and other public transport problems start to emerge.

Transportation as an activity of moving goods and people from the origin to destination creates place utility and time utility, because the value of the goods becomes higher in the destination than in the place of origin. [2] Transportation is a service activity (service activities). Transportation services are needed to assist the activities of other sectors (agriculture, industry, finance, government, transmigration, land-security and others to transport goods and people in their respective activities) [2]

The transportation system has an important role for the development of a city. Implementation of the role of inappropriate transportation systems can have negative impacts that affect the development in all areas of economic, social and environmental. The development of transportation in big cities in Indonesia is increasing due to the growth and development of the city and the rate of population growth.

Besides, according to Tamin [3], one of the causes of congestion in urban areas is the increasing tendency of transportation service users to use private vehicles compared to public transport. In addition to the improving economic conditions leading to higher levels of private vehicle ownership, the declining role of public transport is also due to the low level of public transport service itself. In

essence, the low level of service involves inadequate facilities and infrastructure, long travel time, number of passengers exceeding transport capacity, low level of comfort, inadequate network system, and difficult accessibility to certain areas. In essence, the low level of service involves inadequate facilities and infrastructure like bus shelter and pedestrian path also difficult accessibility to certain areas. In addition to the significant growth in activity, travel patterns have increased considerably along with economic growth. There are 2 (two) different patterns of movement, the first pattern of movement throughout the workday or school, where the trips that occur tend to support more dominant work and school activities, while the second pattern is travel that is for the sake of leisure.

The existences of transportation facilities that serve various urban areas today generally have a lot of poor quality, thus causing various impacts to the community especially for student travel behavior. A good understanding of the factors that influence student travel behavior in general and walking to school in particular so far is not reflected in the provision of public facilities in urban areas. However this very limited understanding is reflected in current government policies based solely on the needs of parent and community preferences [4]

The operation of Bus Rapid Transit in Semarang City which is expected to increase the use of public transportation was less got public interest. But as a new program, there are certainly weaknesses such as service levels; Timeliness; Condition of facilities and infrastructure / facilities, human resources, level of user discipline, and others. There needs to be integration between the pedestrian path with the use of bus stops to increase the use of public transport [5]. Designing high-quality and safe walking and cycling environments, mixed land-use patterns and walking/cycling friendly environments are cardinal features of integrated and sustainable transport and urbanism everywhere accessible urban activities and safe, attractive walking and cycling environs – are particularly vital to the welfare of the neediest members of the world's countries [6]. Individuals walk behavior has been empirically tested for different neighborhood types; land use pattern street network, including accessibility and connectivity and pedestrian environment features. This literature provides evidence of a correlation between various aspects of the built environment and walking trips behavior. [7] By looking at these weaknesses, this research focuses on improving the condition of facilities and infrastructure, so that what is needed to improve the reach of the bus stop service with the location of the school.

The Bus Rapid Transit (BRT) system is a mass-based, road-based freight where it utilizes special and exclusive channels. The Bus Rapid Transit (BRT) system is a mass-based, road-based freight where it utilizes special and exclusive channels. In addition, the system used is a closed system where passengers can go up and down only at bus stops and of course must be equipped with a ticket system either in the form of tickets for one way or subscribe to prepaid mechanism. In order for the passengers to be comfortable on the way to and leaving the bus stop, there are reliable ferry crossing facilities, security officers at every stop, travel time schedule and also the absence of street hawkers either at bus stops or bridges except in designated places. In addition to the easy to get and leave lane bus way then from certain locations will be provided public transport route. Bus way is a special lane for bus trajectory with a view to improving the efficiency of public transport system, which is to shorten travel time and transportation cost [8]. However, the implementation of BRT in the city of Semarang currently have a special line, but preferably on the setting up and down passengers at special stops that have been provided.
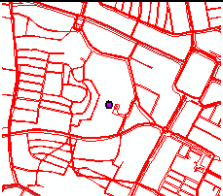
2. Data and Methods
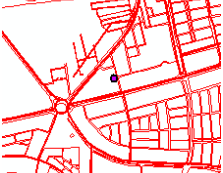
2.1. Data
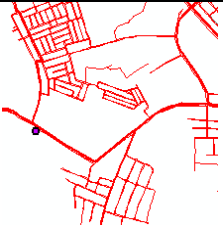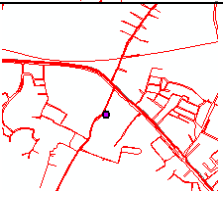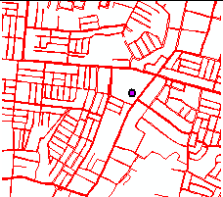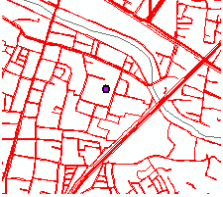
2.1.1. Location of High School
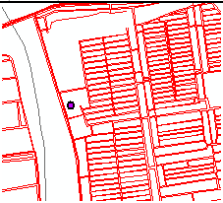
In this study used data from environmental conditions around BRT and High School locations, which included a database of geographic information systems, hard copy maps, aerial photographs,

and data collected from field visits. The high school service area was first divided into a 700-square-meter grid cell and the size of the urban form was collected from the cell containing the school trip route calculated on the basis of the nearest travel route. The provision of school facilities based on SNI is only based on the range of services area without regard to the provision of other infrastructure facilities [9]. Overall, the results of the nearest route map analysis between BRT and SMA locations suggested influencing pedestrian movement patterns: density of land use and diversity, road patterns, pedestrian infrastructure, and traffic levels in the school environment. Of the attributes listed above, those with an area size, such as a road area, are counted as part of a travel route. Other attributes such as pedestrian path conditions should be available to road users based on field observations.

Table 1. The Location of Each (16) High School

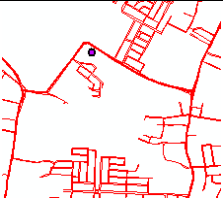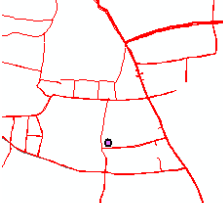| Street Network ● High School (SMA)	High School	Built Environment Around The School
SMA 1		SMA 1 has a strategic location because its located in the center of Semarang city, and nearby there is a provincial government center and shopping center in Simpang Lima Area
SMA 2		SMA 2 is located in a residential neighborhood along the majapahit road corridor which is the main access in the eastern region from the center to the suburbs (Pedurungan - Mranggen)
SMA 3		SMA 3 and SMA 5 are in strategic location because around Tugu Muda area and adjacent to mayor office of city of Semarang
SMA 5		
SMA 4		SMA 4 is located in neighborhood street or in residential area. The distance between the school location and the main road is about 500 meters. There is no adequate pedestrian path around the area.
SMA 6		SMA 6 is located in neighborhood street or in residential area. There is no adequate pedestrian path around the area.

	Street Network ● High School (SMA)	High School	Built Environment Around The School
SMA 7			SMA 7 is located on the main road of the city that connects area A to region B. Although on the main roadside but the location of the school is not bypassed by the BRT line only local public transport.
SMA 8			SMA 8 is located on the main road of the city that connects area A to region B. Although on the main roadside but the location of the school is not bypassed by the BRT line only local public transport. There is no adequate pedestrian path along the main road, and the traffic conditions are quite crowded. This raises issues of security and inconvenience to students to walk along the road
SMA 9			SMA 9 is located on the main road of the city that connects area A to region B. Although on the main roadside but the location of the school is not bypassed by the BRT line only local public transport. There is no adequate pedestrian path along the main road, and the traffic conditions are quite crowded. This raises issues of security and inconvenience to students to walk along the road
SMA 10			SMA 10 is located on the main road of the city that connects area A to region B. Although on the main roadside but the location of the school is not bypassed by the BRT line only local public transport. There is no adequate pedestrian path along the main road, and the traffic conditions are quite crowded. This raises issues of security and inconvenience to students to walk along the road.
SMA 11			SMA 11 is located in neighborhood street or in residential area. There is no adequate pedestrian path around the area.
SMA 12			SMA 12 is located on the main road of the city that connects area A to region B. Although on the main roadside but the location of the school is not bypassed by the BRT line only local public transport. There is no adequate pedestrian path along the main road, and the traffic conditions are quite crowded. This raises issues of security and inconvenience to students to walk along the road.
SMA 13			SMA 13 is located in neighborhood street or in residential area. There is no adequate pedestrian path around the area.

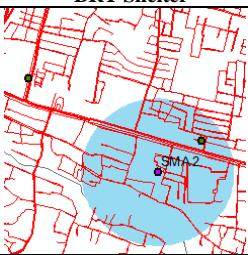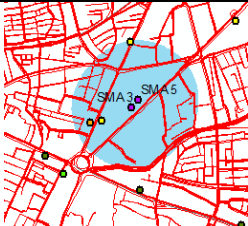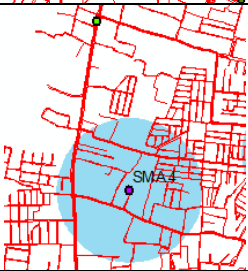| Street Network ● High School (SMA)	High School	Built Environment Around The School
SMA 14		SMA 14 is located on the main road of the city that connects area A to region B. Although on the main roadside but the location of the school is not bypassed by the BRT line only local public transport. There is no adequate pedestrian path along the main road, and the traffic conditions are quite crowded. This raises issues of security and inconvenience to students to walk along the road.
SMA 15		SMA 15 is located on the main road of the city that connects area A to region B. Although on the main roadside but the location of the school is not bypassed by the BRT line only local public transport. There is no adequate pedestrian path along the main road, and the traffic conditions are quite crowded. This raises issues of security and inconvenience to students to walk along the road.
SMA 16		SMA 10 is located on the main road of the city that connects area A to region B. Although on the main roadside but the location of the school is not bypassed by the BRT line only local public transport. There is no adequate pedestrian path along the main road, and the traffic conditions are quite crowded. This raises issues of security and inconvenience to students to walk along the road.
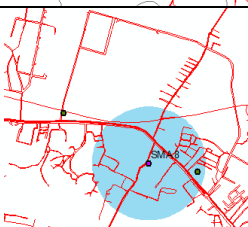
Source: Survey results, 2017
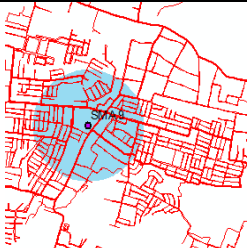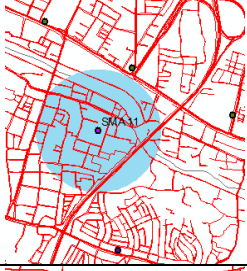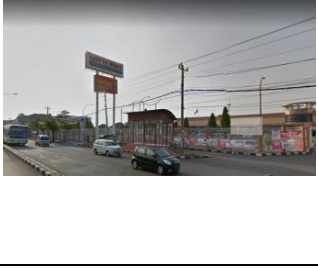
2.1.2. Locations of Bus Rapid Transit Shelter
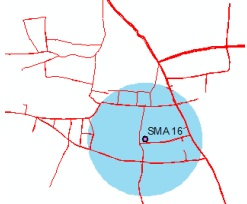
Service coverage is one of the factors in determining the location of shelters. Site determination is determined with minimum distance to walk, i.e. 400m (according to urban housing planning / Standard of National Indonesia [10,11]. High school location within range of the bus stop services currently only around 50% covers 9 high schools (SMA1, SMA 2, SMA 3, SMA 4, SMA 5, SMA 6, SMA 8, SMA 11, SMA 13). Most high schools served by bus stops are located in the downtown area but this is not supported by good pedestrian lines. This condition will indirectly affect the interest of students to use public transportation. Because the use of public transport is not only judged by the performance of conveyance, but also affect the provision of pedestrian facilities as the link between the locations of the school to the bus stop. The description of the condition of the bus stop service to the existing school location in the city of Semarang can be clearly seen in the table and picture below.

Table 2. The Range of BRT Shelter Service to the Location of Each (16) High School
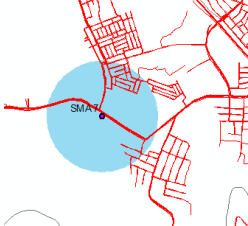
Street Network ● BRT Shelter	BRT Shelter	Built Environment Around the School
SMA 1		The BRT shelter in front of SMA 1 has a strategic location because its located in the center of Semarang city, and nearby there is a provincial government center and shopping center in Simpang Lima Area

	Street Network ● BRT Shelter	BRT Shelter	Built Environment Around the School
SMA 2			School location adjacent to the bus stop which is located beside the road Majapahit, both towards Simpang Lima (50 meters) and toward Pucanggading (200 meters). Not available pedestrian paths on both sides of the road Majapahit. Majapahit road conditions are very crowded, so it provided a bridge crossing to the bus stop towards Pucanggading.
SMA 3 SMA 5			School location adjacent to the bus stop which is located beside the road Pemuda, in front of Mayor Office towards to Tugu Muda (50 meters). Because of its location in the city center has a pedestrian track that is very adequate and comfortable to use for walking
SMA 4			School location adjacent to the bus stop which is located beside the arterial road Semarang Solo, both towards Simpang Lima (50 meters) and toward Bawen (200 meters).
SMA 6			School location adjacent to the bus stop which is located beside the arterial road Semarang Solo, both towards Tugu Muda (500 meters) and toward Kalibanteng (500 meters).
SMA 7			School location not reachable with the BRT shelter location services
SMA 8			School location adjacent to the bus stop which is located beside the arterial road Semarang Kendal, both towards Semarang (500 meters) and toward Kendal (500 meters).

Street Network ● BRT Shelter	BRT Shelter	Built Environment Around the School
SMA 9		School location not reachable with the BRT shelter location services
SMA 10		School location not reachable with the BRT shelter location services
SMA 11		The location of the school adjacent to the bus stop which is on the road Majapahit (500meter)
SMA 12		School location not reachable with the BRT shelter location services
SMA 13		The location of the school is outside the reach of the bus stop service located on the Mijen highway (> 500meter)

	Street Network ● BRT Shelter	BRT Shelter	Built Environment Around the School
SMA 14			School location not reachable with the BRT shelter location services
SMA 15			School location not reachable with the BRT shelter location services
SMA 16			School location not reachable with the BRT shelter location services

*Source: Survey results, 2017*

2.2. Methods

In this study used data from environmental conditions around BRT and High School locations, which included a database of geographic information systems, hard copy maps, aerial photographs, and data collected from field visits. The high school service area was first divided into a 700-square-meter grid cell and the size of the urban form was collected from the cell containing the school trip route calculated on the basis of the nearest travel route. Overall, the results of the nearest route map analysis between BRT shelter and high locations suggested influencing pedestrian movement patterns: density of land use and diversity, road patterns, pedestrian infrastructure, and traffic levels in the school environment. Of the attributes listed above, those with an area size, such as a road area, are counted as part of a travel route. Other attributes such as pedestrian path conditions should be available to road users based on field observations.

3. Result and Discussion

3.1. Location of High School

The location of BRT located at the location of service coverage with a radius of 400m at high school includes Tugu sub-district (SMA 8), Semarang Tengah (SMA 1, 3 and 5), Tembalang (SMA 15), Banyumanik (SMA 4), Pedurungan (SMA 2). While the coverage of services of upper secondary schools that are not served by BRT from 16 sub-districts in Semarang are in Ngaliyan sub-district (SMA 7), Mijen (SMA 13 and SMA 16), West Semarang (SMA 6), Gunung Pati (SMA 12), Genuk (SMA 10), North Semarang (SMA 14), Banyumanik (SMA 9), South Semarang (SMA 11).
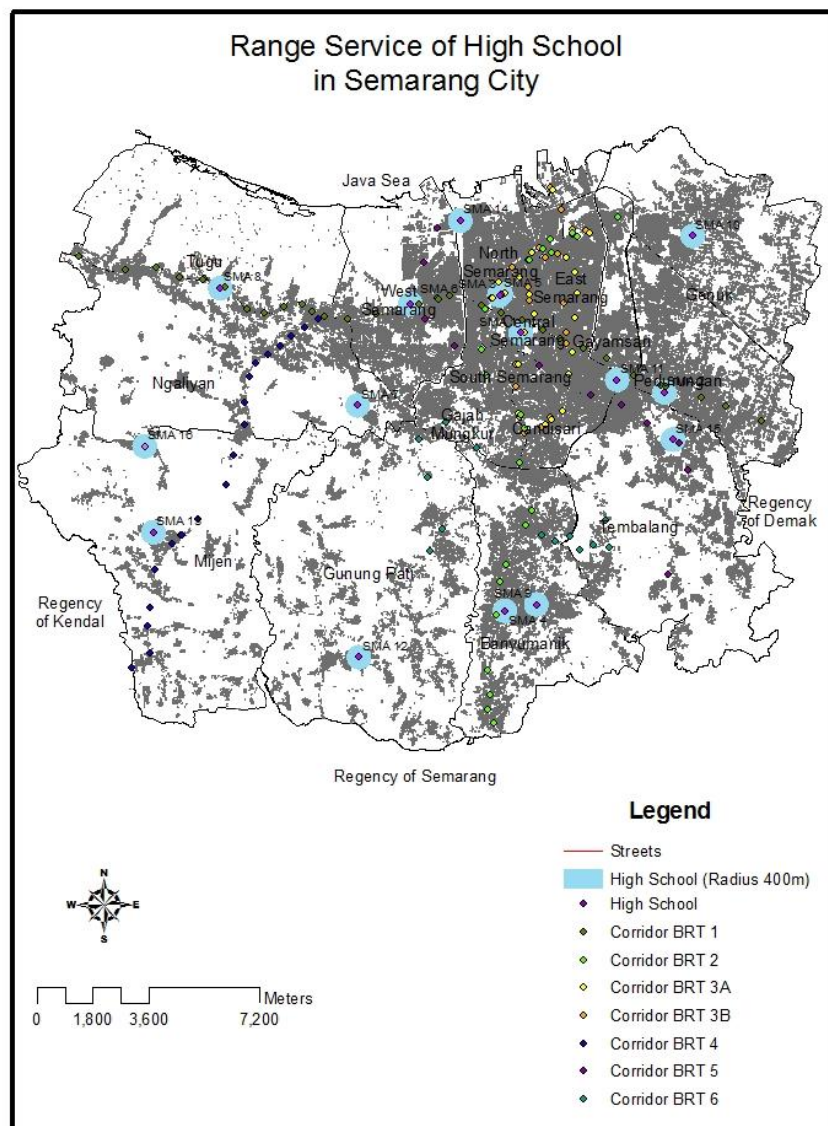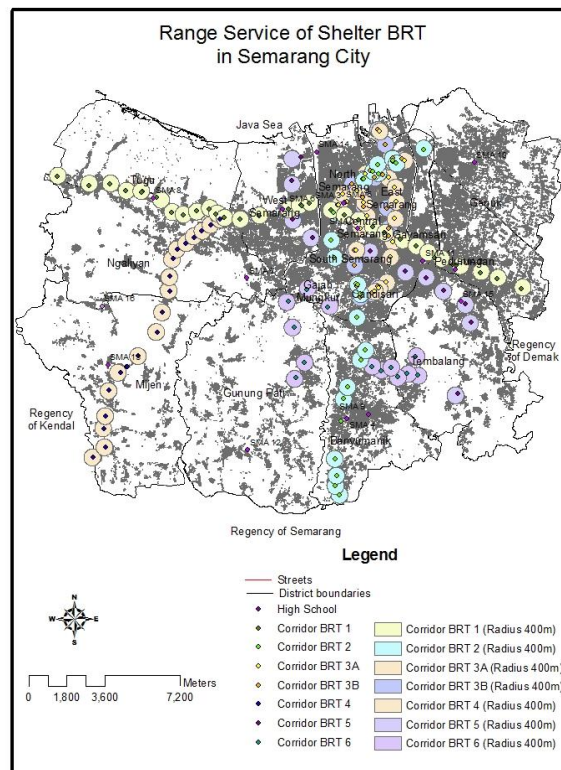
Source: Analysis, 2017

Figure 1. Mapping Range Service of High School to the Location of BRT Shelter in Semarang City

3.2. Locations of Bus Rapid Transit Shelter

Through spatial analysis, it is possible to know the range service of BRT to the reach of high school Services. Based on the analysis, it can be seen that BRT service coverage has been covered in several high school locations spread in various sub-districts in Semarang City. From figure 2, the distribution of the location of both high school and BRT facilities in Semarang City, it can be seen also, the distance / nearest location between the facilities. The proximity between facilities, providing convenience for users in utilizing existing facilities. Through network analyzes it can be seen that the location of the high school facility has the closest route to the location of the BRT facility. Based figure 3 and table 3, on the nearest distance of high school and BRT facilities in Semarang City, it is known that 44% of high school facility has the closest distance to BRT facility, while 46% of high school facility is still not reached by BRT facility.

Source: Analysis, 2017

Figure 2. Mapping Range Service of Shelter BRT to the Location of High School in Semarang City
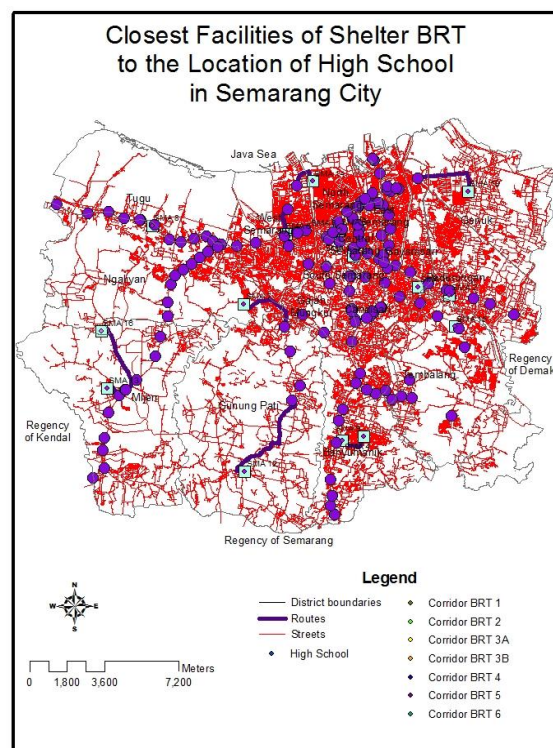
Source: Analysis, 2017

Figure 3. Closest Facilities of Shelter BRT to the Location of High School In Semarang City

Table 3. Facilities Distances (m) of Shelter BRT to the Location of High School In Semarang City

Location Facilities High School - BRT Shelter	Facilities Distances (m)
Location 1 (SMA 8) - Location 6	304
Location 2 (SMA 7) - Location 139	**3154**
Location 3 (SMA 6) - Location 129	**1433**
Location 4 (SMA 14) - Location 128	**1542**
Location 5 (SMA 1) - Location 68	62
Location 6 (SMA 10) - Location 53	**3273**
Location 7 (SMA 2) - Location 27	16
Location 8 (SMA 15) - Location 121	228
Location 9 (SMA 4) - Location 54	374
Location 10 (SMA 9) - Location 54	**1816**
Location 11 (SMA 16) - Location 119	**3366**
Location 12 (SMA 5) - Location 77	37
Location 13 (SMA 3) - Location 77	106
Location 14 (SMA 12) - Location 143	**5605**
Location 15 (SMA 11) - Location 25	**512**
Location 16 (SMA 13) - Location 105	**658**

Source: Analysis, 2017

4.   Conclusion

The existence of a mass public transport in general less public interest. However, for school students using public transportation remains an option. Therefore, in improving public transport services, the city government is expected to pay attention to the placement of the bus stop location and improve or provide a safe pedestrian path. Criteria for placement of bus stops currently not noticed walking distance range for school students. Similarly, the condition of pedestrian paths connecting school locations and bus stops is not well available. Even in some schools in the suburbs of school students walking on the street, it is not safe for them. This is in contrast to the characteristics of pedestrian lanes in the downtown area such as SMA 1 (Simpang Lima) and SMA 3, SMA 5 (in Tugu Muda) connecting the school location and bus stop which is quite good and comfortable.

5.   Acknowledgements

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