The effect of road expansion on the use of space (case study: Simpang Ujung Aji Road section - the boundary of Kabanjahe City, North Sumatra)

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Abstract. The Simpang Ujung Aji road section - the boundary of Kabanjahe City is the road that connects the city of Medan and the city of Banda Aceh. Under one of the missions of the Ministry of Public Works and Public Housing, road widening activities carried out on this road section to improve the accessibility of the area resulting in increased growth of the intersection. This study aims to examine the effect of widening road on space utilization seen from changes in land use before and after. The research approach uses a qualitative approach. The results of the analysis show that road widening affects changes in spatial use, as evidenced by changes in the area of land use and building additions along the road corridors. The results can be used as a reference for academics to be further developed in conducting research in other locations that will be the location of development activities and used as input and information for the Central Government or Karo District Government in making decisions for regional development related to changes in spatial use due to road widening.

1. Introduction
Urban development will go hand in hand with the growth in population, availability of municipal facilities and infrastructure, urban land use for civic community activities, and accompanying socio-economic activities. One consequence that arises from the development of the city is the increasing demand for land to carry out social, economic and other events. This proves that the needs and uses of area are directly proportional to population growth which has implications for the utilization of urban space. If the development of the city is not matched by the availability of sufficient land, there will be competition between land use and potential land use that is not in accordance with its designation.

Facing this problem, the planning of a city or region becomes essential to do. Urban planning is not only related to physical aspects but also the social and economic issues. The development of physical areas that began to cover suburban areas caused the growth of buildings in the periphery to increase.

With increasing urban activity coupled with an increase in population, it has an impact on the increasing level of community movements. While various restrictions on the development and growth of cities are determined by transportation technology and the need to be able to move many people to different places.
The desire to make a move causes city life depend on the smooth transportation, so the consequence is that the government must build facilities and infrastructure to be more adequate to support real economic growth and support the movements that arise due to the growth of such behavior, therefore adequate infrastructure is needed, and one of them is the availability of road infrastructure.

The corridor of the Simpang Ujung Aji road - Kabanjahe city boundary is a national road segment whose authority is in the central government through the Ministry of Public Works and Public Housing. In accordance with one of the missions of the Ministry of Public Works and Housing, which is to accelerate the development of road infrastructure to support connectivity in order to increase productivity, efficiency and service of the national logistics system to strengthen national competitiveness in the global sphere focusing on integrated land and maritime connectivity (PP No. 165.2014). This is one of the factors underlying the government to widen the road in the Simpang Ujung Aji corridor - Kabanjahe City Boundary.

Road widening is very influential on the use of space, which can be seen from the extent of land that has shifted functions, such as productive garden land and vacant land into residential housing and shopping locations.

The growth of transportation networks to the effect of land-use change from the previous plantation and rice fields has shifted functions to residential land, education, and commercial land, as well as the development of increasing land values due to road construction also mentioned by M. Yani (2013). Data analysis carried out in clear manner shows the existence of physical changes and functions of land towards the tasks of trade/services, housing, and offices. This change has deviated from the previous spatial utilization plan, namely to maintain paddy fields, dry land (mixed gardens), and a small portion for the industry. The development of built-up area (public and other facilities) before and after construction along the road corridor occurred and resulted in the conversion of agricultural land (paddy fields) and plantation land to other land uses.

2. Method

In examining the effect of road widening on space utilization in the corridor of the Simpang Ujung Aji - Border City of Karanje Regency, Karo Regency, research was carried out with qualitative descriptive analysis, which explained the general meaning or description of the data obtained in the form of logical and systematic explanations using observation and interview methods.

Library research is the initial stage of research, looking for a theoretical basis that is relevant to the field situation, especially about changes in spatial use due to widening the road and other theories that support it. The research was continued by conducting field research, which was an activity needed to find out more detailed phenomena on land use, the intensity of building utilization, and accessibility in the Simpang Ujung Aji road corridor - the boundary of Kabanjahe City, Karo Regency.

Qualitative descriptive methods have the purpose of collecting data in detail, depth, and actual. In this study, it generally describes the symptoms that already exist such as recognizing problems and checking conditions that are still valid. When using descriptive qualitative research methods, researchers have research objectives to systematically describe particular fact in an actual and thorough manner. Besides, this method also not only describes the analysis but also integrates classification and organization.

The sample in this study were residents who were along the corridor on the Simpang Ujung Aji - Border City Kabanjahe road section and all the road user communities that crossed the road from and out of Kabanjahe City. Because the method used in this study is by interview and so that the research sample can produce more representative data, the sampling technique used is a nonprobability sampling technique, namely purposive sampling, meaning sampling is based on objectives, where the researcher determines sampling by setting the characteristics - unique characteristics or criteria that are in accordance with the goals of the study so that it is expected to answer the research problems.

There are several criteria are considered in choosing speakers in this study, namely:
1. Residents who have settled along the Simpang Ujung Aji - Bts road corridor. Kabanjahe City (Raya Village and Berastagi Village in Berastagi District; Sumber Mufakat Village, Sumbul Village, Kampung Dalam Village, and Ketaren Village in Kabanjahe District) for more than 25 years.
2. Parties who took part in the implementation of the widening of the Simpang Ujung Aji - Bts road section. Kabanjahe City.
3. Parties that interact directly with the benefits of widening the road, in this case, the community of road users.
4. Policy stakeholders related to infrastructure and regional development in Karo District.

In this study, the data collection methods used are as follows:
1. Observation is a way of taking primary data using the senses of sight, hearing, smell, and taste, without the help of other tools for this purpose. Observation is a technique of data collection, where researchers make observations directly to the object of research to see pointly the activities carried out (Riduwan, 2004).
2. Interview
   The interview is a method of collecting data using single question and answer method that is carried out systematically and based on the objectives of the study (Lerbin, 1992 in Hadi, 2007). The one-sided question and answer mean that the active data collector asks while the questioned party actively provides replies or responses. Question and answer are carried out systematically, planned, and refers to the purpose of the research conducted. In study, interviews can function as a primary method where data obtained from interviews is the reading data to answer research problems (Hadi, 1992).
3. Documentation
   Documentation is done by looking for data about things - things or variables in the form of notes, transcripts, books, newspapers, magazines, inscriptions, minutes of meetings, legends, agendas, and so on (Arikunto, 2005). The documentation for this research is by collecting secondary data in the form of the Karo Regency Spatial Plan and the map and principal of the development of Karo Regency.

The list of questions submitted to respondents who are following the criteria set by the author are:
1. For residents who have settled along the Simpang Ujung Aji - Bts road corridor. Kabanjahe City (Raya Village and Berastagi Village in Berastagi District; Sumber Mufakat Village, Sumbul Village, Kampung Dalam Village, and Ketaren Village in Kabanjahe Subdistrict) for more than 25 years:
   - Where exactly is your residence (village)?
   - How long do you stay in the village?
   - What is the land use before and after the road widening?
2. For parties who took part in the implementation of the widening of the Simpang Ujung Aji - Bts road section. Kabanjahe City and stakeholders related to infrastructure and regional development in Karo District:
   - What is the basis for consideration of road widening?
   - What is the land use before and after the road widening?
3. For parties that interact directly with the benefits of widening the road, in this case, the community of road users:
   - What activities do you often do that is related to the use of the Simpang Ujung Aji road segment - Kabanjahe City Limits?
   - What is the land use before and after the road widening?

3. Results and Discussions
The research location is in North Sumatra Province, namely in Karo District (Figure 4.1). Karo Regency with its capital Kabanjahe is located in the Bukit Barisan Mountains and most of it is a plateau. Two active volcanoes are located in this region. Karo Regency is 200 - 1,500 m above sea
level and is the Wampu / Ular River Basin and sub-watershed of the Lau Biang River Basin, all of which lead to the Malacca Strait. In general, this sub-watershed is used to irrigate rice fields as an effort to increase agricultural production.

Geographically, Karo Regency is located in the northern part of the equator, extends eastward between 97°55' - 98°38' East Longitude and extends south between 2°50' - 3°19' North Latitude. It is part of the crossing region in the Western Pacific Trough area with an area of 2,127.25 km² of Karo Regency or approximately 2.97% of the total area of North Sumatra Province. Administratively, Karo Regency has 17 sub-districts with 269 villages, with regional boundaries as follows:

- Langkat Regency and Deli Serdang Regency border the North
- Toba Samosir Regency and Dairi Regency border the South
- Deli Serdang Regency and Simalungun Regency border the East
- Southeast Aceh Regency (Aceh Province) border the West

The interaction of regional development with the road network system (transportation) is an integral relationship in which its influence accumulates over time. An area with all its characteristics offers a specific attraction for the ongoing activities, while the road network system (transportation) provides the necessary accessibility so that the desired actions can be carried out and developed. In relation to regional development, the most rapid growth is in the Medan - Binjai - Deli Serdang - Karo (Mebidangro) area, for that the Ministry of Public Works and Public Housing, as implementing infrastructure development in Indonesia has made various efforts by carrying out network construction and development national roads in all provinces and districts/cities in Indonesia, which in this case is the task of the Directorate General of Highways.

Following the standard road pavement width standard, that for collector national roads the minimum width of the road body is 6 m while the existing Simpang Ujung Aji - Bts road section exists. Kabanjahe City in 1993 was only 4.5 - 5 m. In view of this road linking the flow of traffic from the Province of North Sumatra to the Province of Aceh with a large amount of traffic flow and to meet national road class standards this is the Ministry of Public Works and Public Housing allocating funds for the implementation of road widening work, as conveyed by the Project Leader Road Widening in 1993, Rellus Siagian, namely "Simpang Ujung Aji - Bts. Kabanjahe City is a national collector road, a middle passageway to Aceh Province with reasonably large traffic flow while the existing width of the current road body is only 4.5 - 5 m. To meet the road pavement width standards and to increase national road capacity the road body must be widened to 6 m"... (Personal Interview, Leader of the 1993 Road Widening Project, Rellus Siagian, 14 January 2019)

Karo Regency is a very strategic district in North Sumatra Province. Aside from being an agricultural center, Karo Regency is including in two National Strategic Areas (KSN) namely the Medan-Binjai National Strategic Area - Deli Serdang - Karo (Mebidangro) and the Lake Toba National Tourism Strategic Area (KSPN). To support and develop this potential, supporting facilities and infrastructure are needed, one of which is the availability of reliable transportation infrastructure. This road segment is intended to be able to smooth the flow of traffic from the Province of North Sumatra to the Province of Aceh or vice versa and the rate of inter-city traffic in Karo Regency is passed by heavy vehicles such as trucks and buses and other private cars so that the density of traffic flow caused by an increase in capacity of a solid vehdependable car that will be more vacant.

The following is a statement from the Head of the Bappeda of Karo Regency, Nasib Sianturi, said "accessing the main road from Medan to Karo Regency is the Simpang Ujung Aji - Bts Road Section. Distance from Medan to Kabanjahe City is approximately 70 km. In addition to being the primary access to Karo District and KSPN Danau Toba, the road segment is also the main road to the districts of Dairi, Pakpak Barat, Simalungun, and Aceh Province. However, the capacity of the way in question is inadequate which is cause frequent congestion, especially ways in Kabanjahe and Brastagi City. Therefore, the Karo District Government proposes to the Ministry of Public Works to be able to carry out road widening to accommodate vehicle capacities that are increasingly increasing" (Personal Interview, Head of Karo Regency Bappeda, Siasiuri Fate, 19 February 2019).
Land-use change is an increase in land use from one side of use to another followed by a reduction in other types of land use from one time to the next, or changes in the function of land at different periods (Wahyunto, 2001).

**Table 1.** There are six types of land allotment along the Simpang Ujung Aji - Bts road section. Kabanjahe City, as in the table.

| No. | Land Use                  | (Ha)  |
|-----|---------------------------|-------|
| 1.  | Shoulder                  | 13,44 |
| 2.  | Trade and Services        | 66,55 |
| 3.  | Settlements               | 45,50 |
| 4.  | Agriculture / Plantation  | 73,59 |
| 5.  | Open Space                | 3,81  |
| 6.  | Distribution of Facilities| 14,68 |
|     | Total                     | 217,56|

Overall, the dominant land use was agriculture/plantation with an area of 73.59 Ha and for the least use of land was an open space with an area of 3.81 Ha. The use of trade and service land area of 66.55 Ha is almost entirely locate along the Simpang Ujung Aji - Bts road section. Kabanjahe City Karo District.

Changes in land use in the implementation of development can not be avoid. The increasing need for living space, transportation, and recreational areas will encourage changes in land use. Changes in land use from 1993 - 2019 can be seen in this table.

**Table 2.** Changes in land use from 1993 – 2019.

| No | Land Use                  | 1993 (Ha) | 2019 (Ha) | Changing |
|----|---------------------------|-----------|-----------|----------|
|    |                           |           |           | Ha       | %        |
| 1  | Shoulder                  | 13,44     | 13,44     | 0,00     | 0,00     |
| 2  | Trade and Services        | 48,35     | 66,55     | 18,19    | 8,36     |
| 3  | Settlements               | 57,07     | 45,50     | -11,56   | -5,31    |
| 4  | Agriculture / Plantation  | 74,83     | 73,59     | -1,24    | -0,57    |
| 5  | Open Space                | 11,51     | 3,81      | -7,70    | -3,54    |
| 6  | Distribution of Facilities| 12,37     | 14,68     | 2,31     | 1,06     |
|    | Total                     | 217,56    | 217,56    | 0,00     | 0,00     |

From the table above shows the changes in land use from 1993 - 2019 and the percentage change in existing land use. One of the changes in land use is the use of trade and services in 1993 which reached an area of 48.35 Ha, changing to 66.55 Ha in 2019, an increase of 18.19 Ha. Changes in trade and service land use affect several other land uses. There has been a shift in land use such as settlements/housing reaching 7.62 Ha, agriculture 9.31 Ha, open space 3.69 Ha.

The development of the city will go hand in hand with population growth and accompanying socio-economic activities. One consequence arising from the development of the city is the increased demand for land to carry out social, economic, and other activities. It proves that the need and use of property are directly proportional to population growth has implications for the purpose of urban space. The availability of sufficient land does not match the development of the city, it will result in
competition among land users and lead to potential land use that is not by its purpose. Facing these problems, the planning of a city or region is essential to do. Urban planning is not only related to physical aspects but also the social and economic issues. The development of natural areas that began to cover suburban areas led to increased growth of buildings in the suburbs. That is because the city is no longer able to provide land for its development. The development of cities in this way is also called parallel development.

There are three Regional Spatial Plan Plans in the Karo Regency on the Simpang Ujung Aji - Bts road section. Kabanjahe City. Almost overall the allotment of available space is the planned residential space pattern with an area of 198.70 Ha. In addition to the settlement spatial pattern plan, there is a plan for dryland farming space and horticultural crops. To see the suitability of the Karo Regency Regional Spatial Pattern Plan and the current land use within the research study area, the researchers looked spatially using the superimpose method, for more details, see the overlay results table below. The existing land use that is following with the Karo Regency Regional Spatial Plan there are also some current lands uses that are not under the allotment of space. The use of current settlement land reaches 45.50 Ha and if it adjusted to the Karo Regency Spatial Plan Pattern, the total area following the settlement designation reaches 40.89 Ha and 11.63 Ha, the land use is dryland agriculture. When viewed from the allotment of space for residential land which reaches 199.07 Ha, but if overlay the area of the allocation of settlements including the use of trade and service land, agriculture, open space, and distribution of facilities. The Karo Regency government has determined the large amount of residential space allotment that can be utilized by the community to settle. From the table above shows the area of land use of existing trade and services has an area of up to 64.90 Ha which when viewed from the allotment of space is the allotment of space for settlements.

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