

TRAFFIC MANAGEMENT ON THE CIKERETEG-PANCAWATI ROAD IN THE CARINGIN DISTRICT TOURISM AREA BOGOR DISTRICT

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Abstract

Traffic as part of transportation planning is a vital indicator of tourism development. Bogor Regency is one of the favorite tourist destinations in Jabodetabek. One of the tourist attractions in Bogor Regency is natural tourism around the Puncak Bogor area. This study aims to analyze land use around Jalan Cikereteg-Pancawati, analyze the performance and level of traffic service on the road, and conduct a SWOT analysis for traffic management strategies. The study used GIS to analyze changes in land use and analyzed the level of road service on Jalan Cikereteg-Pancawati. The traffic performance analysis was conducted by analyzing the volume values and degrees of saturation on Sundays and Thursdays. The land use analysis showed that the area is dominated by forests, plantations, and rice fields, indicating great potential as a tourist area. The traffic performance analysis revealed that Sundays have higher volume values and degrees of saturation than Thursdays, with the highest degree of saturation occurring on Sunday segment 3. The study concludes that the traffic management strategy for Jalan Cikereteg-Pancawati should focus on managing pavement repairs and road widening, providing bus and car parking, and utilizing available human resources and supporting regulations for the development of Bogor Regency as a natural tourism area. The study's findings suggest that effective traffic management is crucial for the sustainable development of natural tourism in Bogor Regency. The proposed traffic management strategies can help alleviate traffic congestion and improve the overall tourist experience, ultimately contributing to the region's economic growth and social well-being.

Key words: tourist areas, traffic jams, traffic management

Introduction

Caringin District is one of the sub-districts in Bogor Regency which is famous for its natural tourist attractions and villas, because it is in the Puncak Bogor area. Jalan Cikereteg – Pancawati is a Regency Road in Caringin District, which connects the National Road, Jalan Raya Sukabumi with several leading tourist attractions in the district. Apart from the many natural tourist attractions and villas around Jalan Cikereteg - Pancawati, there are also land uses as commercial areas or markets, housing, industry and so on. According to Rachman (2020), land use is a series of activities for structuring, regulating, allocating and using land in a planned manner for human activities based on applicable rules and systems. Basically, every development carried out on land has its own concept in the activity process (Ristiyanto & Firdaus, 2021; Purba, 2016). Many problems related to land are triggered by increasing development activities. In short, land use can be said to be governance for land use. Land use is land utilization activities carried out by humans in order to fulfill their living needs (Sitoru, 2017; Izakovičová, et al, 2018). Land use is very important to study because it is closely related to regional development.

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Transportation Planning is an important part of Regional and City Planning. Based on the Regulation of the Minister of Agrarian Affairs and Spatial Planning/Head of the National Land Agency of the Republic of Indonesia Number 1 of 2018 concerning Guidelines for Preparing Provincial, Regency and City Spatial Planning, transportation planning is important as part of preparing the spatial structure of cities and districts. According to Tamin (2000) and Aziz (2018), traffic is influenced by land use. In meeting their daily needs, each individual moves from certain land uses to other land uses. This creates a very close relationship between land use and transportation.

The growth rate of movement is very high and cannot be slowed down, while transportation facilities and infrastructure are very limited, resulting in impaired accessibility and mobility (Hukmia, 2015; Banister & Berechman, 2001). Traffic performance analysis was carried out to theoretically determine the traffic conditions of the Cikereteg - Pancawati Road network. Traffic performance analysis uses parameters of the degree of saturation (V/C Ratio), as well as the level of road service. The degree of saturation is defined as the ratio of traffic flow (Volume) to road capacity (Miro, 2004; Ridhani, et al, 2021). From the description above, this research aims to determine the land use around Jalan Cikereteg – Pancawati, analyze the traffic performance of this road, and traffic management strategy for congestion solution in tourism area.

Research Methods

Research Location

The research location is along Jalan Cikereteg – Pancawati, Caringin District, Bogor Regency. The Cikereteg – Pancawati road has a section length of 5.5 km which passes through two villages, namely Ciderum Village and Pancawati Village. The research location can be seen in Figure 1.

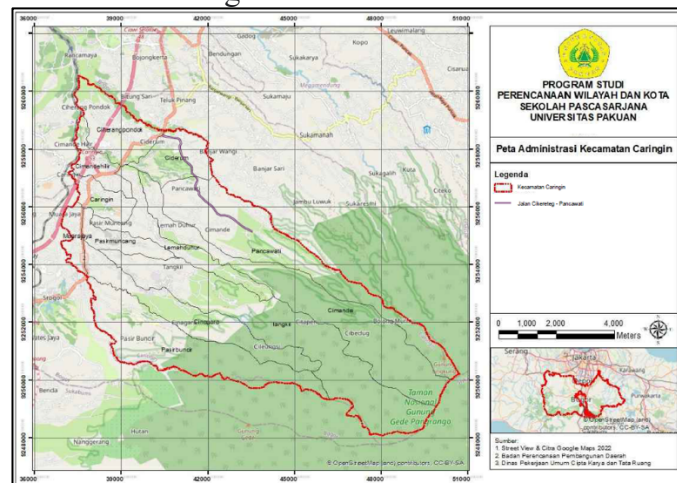


Figure 1. Research Location

Research Technique

Data Collection Technique

Data collection consists of two types, namely, secondary and primary. The secondary data used is satellite imagery and RTRW maps of Bogor Regency obtained from the Bogor Regency PUPR Service. The primary data used is road segment inventory data and traffic volume on Jalan Cikereteg – Pancawati

Analysis Method

Stage 1: Analyzing land use around Cikereteg – Pancawati Roads

Spatial analysis (reclassify) is used to classify land use at the research location based on the Bogor Regency RTRW spatial pattern map for 2016-2036 and existing land use from Google Eart images 2022. Next, descriptive analysis is used to describe land use at the research location based on villages and segment areas. road.

Stage 2: Analyzing the level of traffic service on Cikereteg – Pancawati Roads

Road segment performance analysis based on (Direktorat Jenderal Bina Marga Departemen Pekerjaan Umum, 1997) uses the following formula:

$$DS = V/C$$

Where :

DS = Degree of Saturation,

V = Traffic flow volume (SMP/hour),

C = Road capacity (SMP/hour)

The level of road service has a range between A and F with the following limits:

A: *DS* = 0,00 – 0,20

B: *DS* = 0,21 – 0,44

C: *DS* = 0,45 – 0,74

D: *DS* = 0,75 – 0,84

E: *DS* = 0,85 – 1,00

F: *DS* > 1,00

Stage 3: Analyzing of traffic management strategy for Ciketereg-Pancawati Roads

SWOT analysis is a systematic identification of strategic factors to formulate a strategy. Strategy is a very important tool to achieve goals. After the external and internal matrices are formed, a SWOT matrix is formed which explains various alternatives that can be used as company or institutional strategies. The next analysis is based on logic that can maximize strengths and opportunities, but simultaneously minimize weaknesses and threats.

Results and Discussion

Land Use Around of Cikereteg – Pancawati Roads

The Cikereteg – Pancawati road crosses two villages in Caringin District, namely Ciderum Village and Pancawati Village. Based on the Bogor Regency RTRW Spatial Pattern for 2016-2036, the composition of the planned spatial pattern in Ciderum Village and Pancawati Village can be seen in table 1, figure 2.

Table 1. Spatial Pattern of Ciderum and Pancawati Villages in RTRW 2016-2036

Spatial Pattern	Ciderum	%	Pancawati	%	Total	%
Conversion Forest	0.00	0.0%	410.21	33.3%	410.21	25.7%
Industrial Designation Area	15.88	5.4%	0.00	0.0%	15.88	1.0%
Agriculture	171.39	47.4%	318.41	25.8%	489.80	30.7%
Plantation	0.00	0.0%	252.21	20.5%	252.21	15.8%
Rural Settlement	18.55	5.1%	251.55	20.4%	270.11	16.9%
Urban Settlement 1	5.73	1.6%	0.00	0.0%	5.73	0.4%
Urban Settlement 2	150.28	41.5%	0.00	0.0%	150.28	9.4%
Total	361.84	100.0%	1232.38	100.0%	1595.2	100.0%

Source: (RTRW Kabupaten Bogor 2016-2036, n.d.)

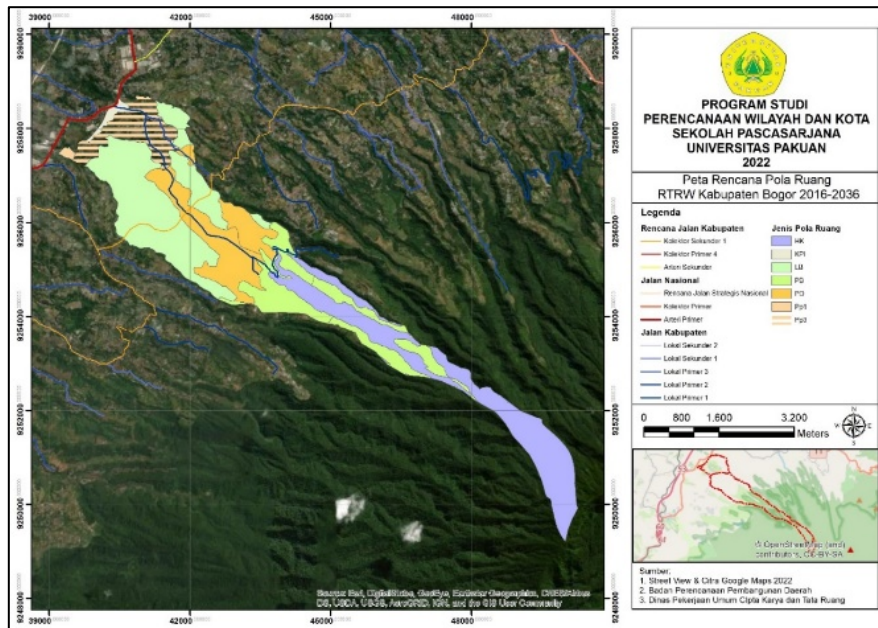


Figure 2. Spatial Pattern Planning on RTRW in Research Location

Based on the results of the analysis, it can be seen that Pancawati Village tends to be more dominantly used to support the function of protected areas because it is close to Mount Gede Pangrango. Ciderum Village is dominated by wetlands and lowdensity urban settlements or PP1. With this spatial pattern plan, Ciderum Village tends to have a higher population density than Pancawati Village. Apart from that, activities in Ciderum Village are more diverse than Pancawati Village. This could have implications for movement patterns which will also be higher in Ciderum Village.

Based on the results of interpretation and analysis of Google Earth imagery in 2022 and the results of ground checks, the land use of the observation locations is classified into 12 types, including: thickets, tourism, forests, industrial, commercial, educational, plantations, rural settlements, urban settlements, irrigated rice fields, rain-fed rice fields and moorlands (Yang et al., 2022). The land use map and area table for each type of land use are as shown in Table 2 and Figure 3.

Table 3. Spatial Pattern of Ciderum and Pancawati Villages in 2022

Spatial Pattern	Ciderum	%	Pancawati	%	Total	%
Thicket/Bush	0.00	0.0%	5.44	0.4	5.44	0.3%
Café & Tourism	7.51	2.1	23.97	1.9	31.49	2.0
Dense Forest	0.00	0.0	470.78	38.1	470.78	29.6
Industry	1.39	0.4	1.16	0.1	2.55	0.2
Commercial	46.46	13.1	1.00	0.1	47.45	3.0
Education	0.81	0.2	1.73	0.1	2.53	0.2
Plantation	48.57	13.7	164.58	13.3	213.15	13.4
Rural Settlement	47.20	13.3	174.81	15.2	222.01	14.0
Urban Settlement	35.88	10.1	0.00	0.0	35.88	2.3
Irrigation Rice Fields	139.88	39.5	380.84	30.9	520.72	32.8%
Rain-Fed Rice Fields	22.79	6.4	6.82	0.6	29.61	1.9
Moor	3.36	0.9	3.19	0.3	6.55	0.4

Spatial Pattern	Ciderum	%	Pancawati	%	Total	%
Total	353.85	100	1235.32	100	1588.17	100

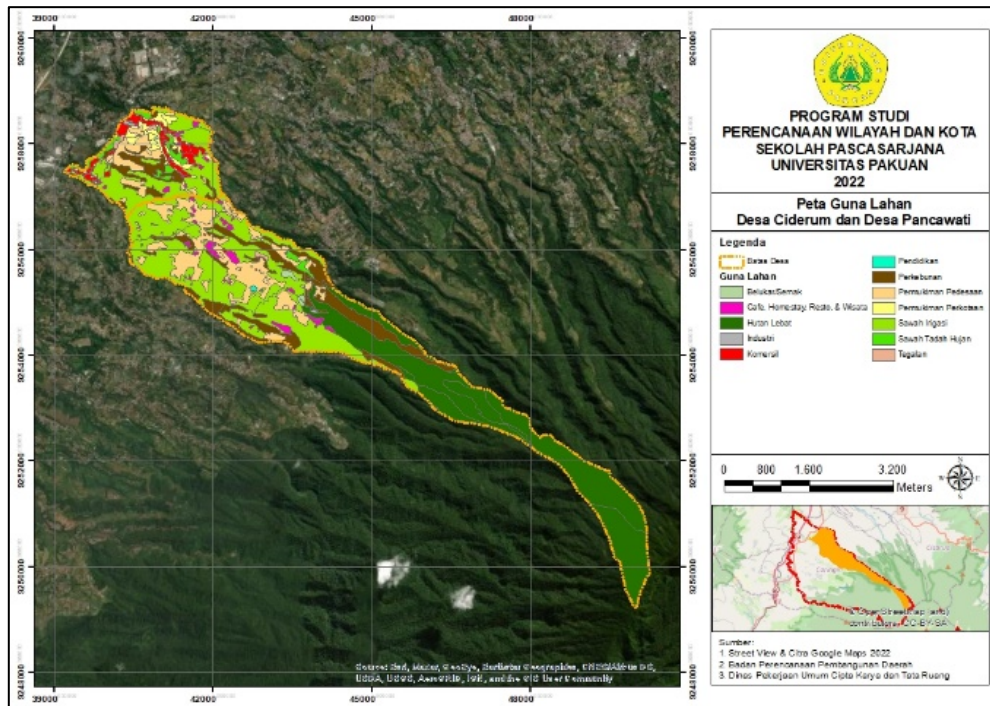


Figure 3. Spatial Pattern on Ciderum and Pancawati Villages

Based on the results of the analysis, the current condition of land use in Ciderum Village and Pancawati Village is in line with the Bogor Regency RTRW spatial pattern. In more detail, Ciderum Village has greater commercial land use than Pancawati Village. Commercial land uses in Ciderum Village include: markets, shops, food stalls, pharmacies, repair shops, etc. This condition can cause quite large travel generation because trade and service activities produce activities that interact directly with human movement. Meanwhile, in Pancawati Village, land use is dominated by forests and rice fields. Land uses in Pancawati Village that have the potential to generate traffic are accommodation, cafes, restaurants and tourism with an area of approximately ± 23.97 hectares.

Level of Services Cikereteg – Pancawati Roads

Road service level or Level of Service (LOS) is the ability of a road to carry out its function (Dong et al., 2020). The level of road service can indicate the overall performance condition of the road section. The level of road service is determined based on quantitative values, one of which uses the V/C Ratio parameter. V/C Ratio is the number of vehicles (Volume) on one road segment at one time compared to the theoretical capacity of that road. To analyze the level of road service, Jalan Cikereteg – Pancawati is divided into four segments.

Traffic volume surveys are carried out by manually counting the number of vehicles passing through a road section in one unit of time. The counting survey was carried out over 2 days, namely holidays and working days. The holiday is taken on Sunday 8 January

2023 and the working day is taken on Thursday 11 January 2023. The traffic volume from the survey results can be seen in Figure 4.

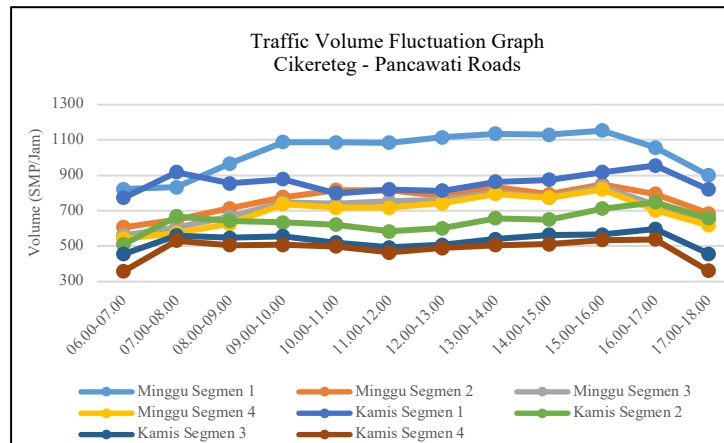


Figure 4. Traffic Volume Fluctuation in Cikereteg – Pancawati Roads

From the results of the traffic volume survey, it was found that volume data on Sunday was higher than on Thursday. The highest volume on Sunday occurred in the afternoon, 15.00 – 16.00, amounting to 1153 SMP/hour. The traffic volume in each segment has decreased from segment 1 to segment 4. This could happen because segment 4 is the end of Jalan Cikereteg - Pancawati, apart from that the land use in segment 4 is dominated by dense forest and there are few residential houses.

The road capacities of the 4 segments of Jalan Cikereteg – Pancawati can be seen in tables 4 and 5. The capacity values are obtained using the following formula (Direktorat Jenderal Bina Marga Departemen Pekerjaan Umum, 1997):

Table 4. Inventory of Cikereteg – Pancawati Roads

Segment Area	Road Lane Type	Width of Road (m)	Shoulder Width (m)	Split Direction	Side Obstacles
Segment 1	2/2 UD	5.0	1.0	50-50	High
Segment 2	2/2 UD	5.0	1.0	50-50	Currently
Segment 3	2/2 UD	4.0	0.5	50-50	Currently
Segment 4	2/2 UD	4.0	0.5	50-50	Currently

Table 5. Capacity Cikereteg – Pancawati Roads

Area Segment Area	Base Capacity / Co (smp/hour)	Adjustment Factor				Actual Capacity / C (smp/hour)
		FC w	FCs p	FCs f	FCc s	
Segment 1	2900	0,56	1,00	0,86	1,04	1453
Segment 2	2900	0,56	1,00	0,92	1,04	1554
Segment 3	2900	0,32	1,00	0,89	1,04	856
Segment 4	2900	0,32	1,00	0,89	1,04	856

Jalan Cikereteg - Pancawati segment 2 has a greater capacity value than segment 1 because the side obstacles in segment 2 are categorized as medium while the side obstacles in segment 1 are categorized as high. The capacity value of the Cikereteg – Pancawati Road in segments 3 and 4 has a very small value, namely 856 because the road is only 4 meters wide.

Based on data on traffic volume and road capacity, the degree of saturation (DS) value for Jalan Cikereteg – Pancawati can be obtained. The DS value from Jalan Cikereteg – Pancawati can be seen in table 6.

Table 6. Nilai DS Value and Level of Service Cikereteg – Pancawati Roads

Day Segment	Capacity	Highest Volume	DS	Level of Services
Sunday Segment 1	1453	1153	0,79	D
Sunday Segment 2	1554	849	0,55	C
Sunday Segment 3	856	837	0,98	E
Sunday Segment 4	856	821	0,96	E
Thursday Segment 1	1453	956	0,66	C
Thursday Segment 2	1554	748	0,48	C
Thursday Segment 3	856	597	0,70	C
Thursday Segment 4	856	538	0,63	C

DS value that is close to 1 indicates that the performance or level of road service is getting worse. The service level of Jalan Cikereteg Pancawati segments 3 and 4 on Sunday shows the worst value at level "E" which has the characteristics of unstable traffic flow, speed sometimes stops and demand is approaching capacity. The low service level values in segments 3 and 4 are not only due to the high traffic volume but also due to the inadequate road width of 4 meters, resulting in the road capacity being small. Meanwhile, on Thursday, the level of road service in all segments was still at level "C", which has the characteristics of stable traffic flow and controllable vehicle speeds.

Traffic Management Strategy for Cikereteg-Pancawati Roads

The results of identifying internal and external factors to analyze various problems and opportunities in efforts to formulate traffic management strategies for the Cikereteg-Pancawati Road are as follows: internal environment in the form of strengths: development of sustainable tourist areas in Cikereteg District; and the increasing growth of tourists every year; Weaknesses: Congestion occurs on the area's main roads and nodes; and the high number of traffic accidents. External environmental analysis: Opportunities: development of restaurants/lodgings and natural tourist areas; and development of community activities and changes in regional land use. Threats: High levels of congestion and traffic congestion along main roads; and Potential for uncontrolled space use due to massive land conversion.

Traffic management strategies. management of pavement repairs and road widening, provision of bus and car parking provision of shuttles or public transportation from bus parking to tourist attractions and utilization of the available human resource potential of management organizations and supporting regulations for the development of Bogor Regency as a natural tourism area and others.

Conclusions

Results of land use analysis Overall, currently land use in Ciderum Village and Pancawati Village is in line with the Bogor Regency RTRW spatial pattern. The land use around Jalan Cikereteg – Pancawati is dominated by forests, plantations and rice fields, which means the area has great potential as a natural tourism area. The results of the analysis of traffic performance on Jalan Cikereteg - Pancawati show that Sundays have higher volume values and degrees of saturation than Thursdays. The highest degree of saturation value occurred on Sunday segment 3 with a DS value of 0.98, which means that at level "E" service level, the traffic flow characteristics are unstable, speed sometimes stops and vehicle volume is approaching capacity. Traffic management strategies. management of pavement repairs and road widening, provision of bus and car parking provision of shuttles or public transportation from bus parking to tourist attractions and utilization of the available human resource potential of management organizations and supporting regulations for the development a natural tourism area and others. Suggestions for developing research require a correlation analysis between tourist land use and the degree of saturation on Jalan Cikereteg - Pancawati. Suggestions for regional development activities around Jalan Cikereteg – Pancawati must be in line with the Bogor Regency RTRW.

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