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The Geometric Evaluation of Jalan Majalengka-Cikijing West Java

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ABSTRACT

Highways are one of the land transportation accesses that support human movement in driving and sending goods from one region to another. The geometric of the road is the highway building above the ground level both vertically and horizontally with the assumption that the ground surface is not flat. Horizontal alignment is often referred to as road situation or road alignment. Corners are where the horizontal alignment is most important. A transverse slope at a bend called superelevation counteracts the centrifugal force the automobile experiences as it makes the turn. The quantitative method can also be interpreted as a research method that looks at reality, symptoms, and phenomena that can be classified, are comparatively constant, tangible, measurable, and observable, and there is a causal link between the symptoms. This study's road evaluation used a 60 km/h design speed and 3.5 m of road width. Using the contour data obtained, road evaluation was carried out using AutCAD® Civil 3D. Based on the calculation results above, the Majalengka-Cikijing road is a hill road type. Then, for the horizontal alignment with a speed of 60 km/hour, the results obtained from 11 horizontal alignments all belong to the Spiral-Cirle-Spiral alignment type.

1. Introduction

Highways are one of the land transportation accesses that support human movement in driving and sending goods from one region to another. In the sphere of construction, a nation or region's socioeconomic progress cannot be advanced without an efficient roadway infrastructure network. Road development in developing nations seeks to link remote locations and promote economic growth by improving people's mobility (Salsabila et al., 2022). Likewise, in East Asia, namely China, the financial sector is developing very rapidly. China's economy has grown mostly as a result of massive investments made in the development of its transportation and road networks.(Kanwal et al., 2022).

In Southeast Asia, Indonesia currently has over 230 million people (Rizki et al., 2022). It is also behind developing countries' road infrastructure development and increasingly advanced transportation. However, institutions urge maximum road building due to the growing importance of roads and their high traffic volume, which benefits road users (Ulchurriyyah et al., 2022). Highways are one of the infrastructures for transportation that sustain the economy, thus every day activities can be employed to facilitate swift, simple, secure, convenient, and efficient traffic operations. The assessment location will be Majalengka, one of the districts in West Java that is currently growing in the tourism and trade sector. This has a positive impact on the economy and social welfare. One of the supporting factors for realizing prosperity and improving public services is improving the road network and the orderly

opening of new road networks (Hatam et al., 2018). However, there will be an adverse impact on road users so that undesirable things such as accidents and traffic jams often occur, so if you want to solve these problems you have to do an evaluation provided by the current road, using methods founded on safety condition verification standards that make reference to the geometry of the route (Cantisani & Del Serrone, 2020).

Government Regulation No. 34 of 2006 and Republic of Indonesia Law No. 38 of 2004 about road status categorize roads such as City Roads, Village Roads, Provincial Roads, National Roads, and Regency Roads (Rizqi et al., 2022). Jalan Majalengka-Cikijing is one of the provincial roads in Majalengka Regency. This road has an impact on accidents because there are many sharp bends. Because of that, an evaluation was carried out on the road by reviewing it regarding horizontal and vertical alignment (Nugroho et al., 2022). Based on the discussion above, it is necessary to carry out a geometric evaluation of the road on the Majalengka-Cikijing road section according to the road geometric design guidelines. 20/SE/Db?2021.

2. Literature Review

2.1 Road Geometry

The highway building is located both vertically and horizontally above ground since it is expected that the ground surface is not level. It is a part of the design of a road that prioritizes physical form planning to give traffic and access between areas the best possible service (Gunawan et al., 2022). Road geometric planning seeks to create a increasing the ratio of use to implementation costs while providing secure infrastructure and effective traffic flow services.

In order for the road to fulfill its fundamental purposes of providing the best possible comfort for traffic flow, safety and mobility concerns that have competing interests are taken into consideration throughout the design process (Paikun et al., 2021). Therefore, these two considerations must be balanced; the mobility that is considered concerns not only the mobility of motorized vehicles but also the mobility of four-wheeled vehicles and pedestrians.

Layouting the road's geometric elements, such as the alignment of the vertical and horizontal axes (Suraji & Mulyono, 2022), both of which have a road coordination relationship. To create a decent road design that makes it easier for drivers to operate their vehicles securely and pleasantly, horizontal and vertical alignment must be coordinated.

2.2 Horizontal Alignment

When a road's axis is projected into the horizontal plane, a set of points known as a horizontal alignment forms an arch or tangent (Arifin & Rifai, 2022). Horizontal alignment is often referred to as road situation or road alignment. Corners are the most important places for horizontal alignment because centrifugal force pushes the vehicle out of the curve region.

VR stipulates that the longest straight line possible segment of road has to be completed in a subsequent time of more than 2.5 minutes in order to account for the safety factor for other road users, including driver weariness. Particularly before and after a circular arc bend, curves are constructed with transitions in mind to prevent abrupt changes in alignment between circular and straight shapes. Three components make for the horizontal alignment: a straight line at 0°, a circular curve that is constant, and a transition curve that is changing. These components are attached to the longitudinal axis of the body and the vehicle's steering wheel. When the curvature is zero (0°), the running track's line has an infinite radius (Farid et al., 2022).

2.3 Superelevasi

A transverse slope at a bend known as superior elevation balances the centrifugal force applied to the vehicle as it navigates the bend. To ensure that the cars can maneuver a curve by ensuring a seamless transition between increasing and decreasing centrifugal forces (Molla, 2020).

Then, because height information was absent from the geo-data examined for this investigation, superior elevation was excluded from the road curvature model (Kaneswaran, 2019). For example, adequate superior elevation is essential for the vehicle to navigate horizontal bends safely. If improperly planned, poor s superior elevation can cause catastrophic highway departure crashes.

superior elevation will be achieved gradually from normal cross-fall on straight road sections to full grade on curved sections. Similarly, when braking, a car may slide and skid laterally due to an incorrect cross slope (Gupta et al., 2020). In addition, information about cross-sectional gradients helps in tasks such as reconstruction and accident investigation.

3. Method

The method used in this research is quantitative. A sample in quantitative data analysis is a portion of the information obtained through surveys or in-depth observations (Rahman et al., 2022). The quantitative method is also a research approach that examines phenomena, realities, and measurable, classifiable, concrete, observable, and quantifiable symptoms with a causal relationship between them. Applying the quantitative approach, the Majalengka-Cikijing route is observed, measured, and other trending activities are carried out from Sindangkerta Village to South Maja. Next, in order to collect the data, focus groups, interviews, and observation are frequently employed qualitative methods. (Barrett & Twycross, 2018). Thus, in conducting research using this quantitative method, we must survey the location to be examined directly. This research was located on the Majalengka-Cikijing highway, which starts from Sindangkerta to South Maja in Majalengka Regency, which has a length of 3.85 km. The research location is in the picture.

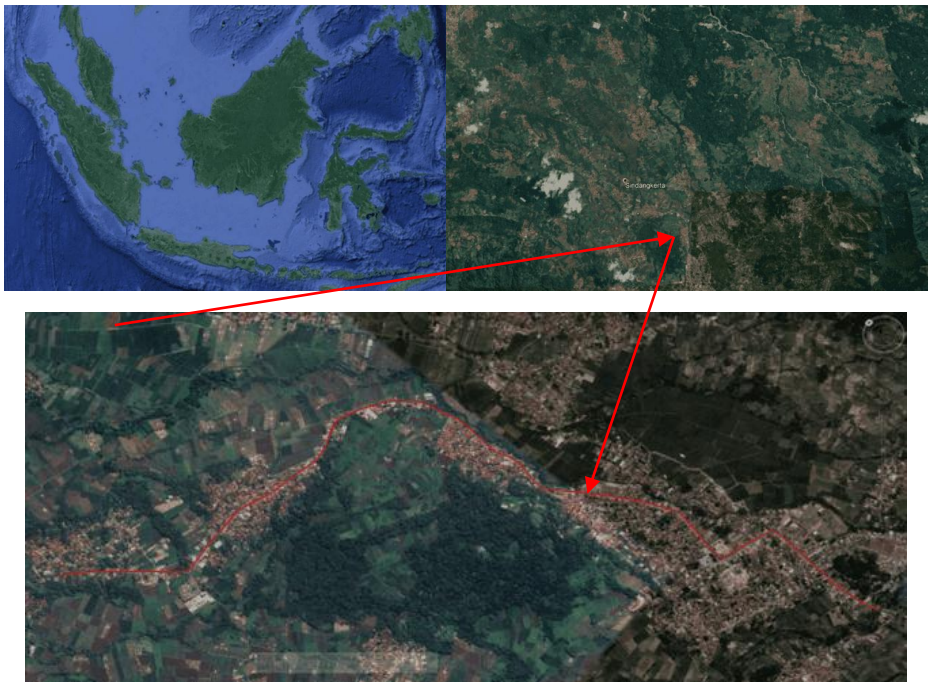

Figure 1. Research Location

The data collection method is essential to research since it provides researchers with a management tool or a means of obtaining the necessary information (Aini et al.). This study's technical data collection, which includes primary and secondary data, will continue to be conducted on Sunday mornings until it is completed.

Both observation and direct field observation are sources of primary data, and several observations are made during direct field observation. This direct observation generates the necessary data, which include general data, data on road geometry, data on environmental conditions, etc. Simultaneously, the supporting information utilized to compile the final findings is known as secondary data. Instead of being directly seen in the field, this secondary data is gathered from relevant parties like offices, agencies, and so on.

4. Result and Discussion

The Majalengka – Cikijing road section's road geometric evaluation, The road geometric design guidelines (PDGJ) state the following.:

4.1 Criteria design

The following information is derived from the Majalengka – Cikijing road research findings :

Table 1. Road Planning Data

Known Data		
Road Function	Class II Primary Local Road	
Road Criteria		
Medan Classification	Bukit	
Configuring the Path	2/2-TT	
Plan Pace	60	km/h
Ruja width	16	m
Rumija width	16	m
Ruwasja Width	7	m
Lane Width	3,5	m
Inside Shoulder Width	0	m
Outer Shoulder Width	1	m
Median Width	0	m
Normal Superelevation	2	%
Shoulder Superelevation	6	%
Maximum Superelevation	8	%
Maximum Elevation	6	%

4.2 Trace

For the study's road evaluation, the design speed and road width were 60 km/h and 3.5 m, respectively. With the collected contour data, AutCAD® Civil 3D was used to evaluate the roads. Road traffic is gathered and separated into eleven areas of interest, as shown in the image, starting with and finishing at STA 0+000 and STA 3+850.

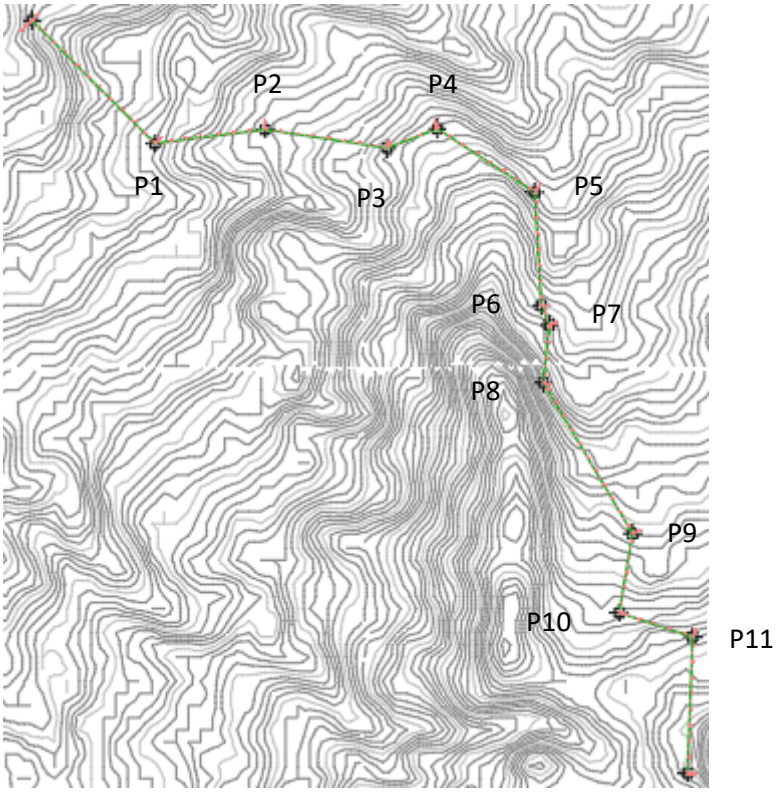

Figure 2. Planning of Trase

Then, based on the calculation at the bend angle on the Majalengka - Cikijing road are as follows:

Table 2. Hasil Perhitungan Sudut Tikungan

TITIK	COORDINATES		JARAK			Azimuth	Sudut Tikungan
	X	Y	ΔX (m)	ΔY (m)	d (m)	α	Δ
A	200185,00	9239558,00					
			387,00	-387	547,3006	135	
PI1	200572,00	9239171,00					**52,227**
			347,00	44	349,7785	82,7734	
PI2	200919,00	9239215,00					**15,838**
			383,00	-58	387,3668	98,6112	
PI3	201302,00	9239157,00					**29,286**
			159,00	60	169,9441	69,3256	
PI4	201461,00	9239217,00					**53,711**
			306,00	-199	365,0164	123,037	
PI5	201767,00	9239018,00					**53,597**
			21,00	-357	357,6171	176,634	
PI6	201788,00	9238661,00					**18,919**

			25,00	-61	65,9242	157,714	
PI7	201813,00	9238600,00	-19,00	-182	182,9891	5,95984	**151,755**
PI8	201794,00	9238418,00	281,00	-476	552,754	149,445	**143,485**
PI9	202075,00	9237942,00	-42,00	-249	252,5173	9,57423	**139,871**
PI10	202033,00	9237693,00	231,00	-77	243,4954	108,435	**98,861**
PI11	202264,00	9237616,00	-16,00	-429	429,2983	2,13592	**106,299**
B	202248,00	9237187,00					**2,136**

4.3 Alignment Horizontal

based on the conclusions of the present road's horizontal alignment research, eleven sites of interest for the geometric assessment of the road are included in the computations. Of these, the radius of eleven curves is smaller than Rmin = 141.732 m. Furthermore, the horizontal alignment evaluation findings yield eleven curves of the Spiral-Circle-Spiral type.

4.4 Superelevation

Superelevation is the road's cross-slope at a curve that counteracts the centrifugal force applied to the vehicle when cornering. It is expressed as a percentage. The supervision diagram based on the computation is shown in the figure below.

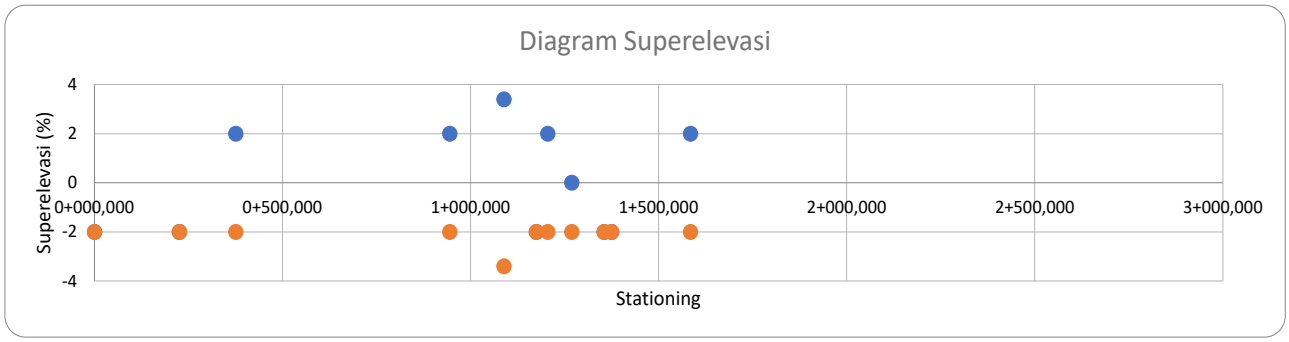

Figure 3. Planning of Trase

5. Conclusion

According to the above computation findings, the Majalengka-Cikijing road is a sort of hill road. Subsequently, for the 60 km/h horizontal alignment, all 11 horizontal alignment findings fall under the Spiral-Circle-Spiral alignment category. Additionally, the assessment discovered that all alignments'

straight section, bend, transition curve, and elevation lengths satisfied the requirements of the Road Geometric Design Guidelines (PDGJ), negating the need for any changes to the horizontal alignment design.

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