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ROAD GEOMETRIC PLANNING USING AUTOCAD® CIVIL 3D: A CASE STUDY OF LEUWIKIDANG HIGHWAY, MAJALENGKA

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ABSTRACK

Jalan Raya Leuwikidang is a land transportation infrastructure that plays an important role in the field of transportation, especially in the distribution of goods and services. The road has horizontal and vertical alignment and is slightly less safe for road users. This study aims to review the horizontal and vertical alignment analysis and compare the results of the review with the planning results based on road convenience. This research method uses quantitative methods. The data used in this study are the results of a review of horizontal alignment, vertical alignment, superelevation, jph and jpm.

1. Introduction

Roads have an important role in life, including facilitating the flow of distribution of goods and services, as corridors connecting one region to another, which can improve the economy and people's standard of living. The geometric design of the road greatly influences the safety and comfort of road users, which is a top priority and a basic requirement in highway planning (Lubis, Rangkuti, & Ardan, 2019). Transportation is the movement of people or goods from one place to another or from a place of origin to a destination using a vehicle driven by humans, animals or machines in socio-cultural, office or educational settings (Masitoh, Rozy, & Anwar, 2020). Highways are divided into several sections, namely National Roads, Provincial Roads, Regency Roads, City Roads and Village Roads in accordance with Republic of Indonesia Law No. 38 of 2004 and Government Regulation no. 34 of 2006 concerning road status. The development of a city greatly affects changes from time to time. These developments occur in urban areas so that land use is decreasing and the environment will continue to change over time, thus causing a greater number of vehicle movement factors in an area (Masuara, Kadir, & Patuti, 2022). Correct geometric criteria are required for road planning. This standard was developed to evaluate how well a road is designed. The geometric design of highways is related to the design of cross-sectional elements, visibility, alignment, curves, super elevations, and others (Rizqi, Rifai, & Bhakti, 2022). Based on the Urban Road Geometry standard (RSNI T - 14 – 2004), geometric planning for urban roads consists of two stages, namely horizontal alignment and vertical alignment. The geometric design of the road consists of Horizontal Alignment and Vertical Alignment. With the development of computer technology, design optimization has been carried out, so that the design process which originally required a long time can be accelerated and simplified (Suwandi & Harun, 2022).

One of the cities of Majalengka, precisely on Jalan Raya Lewikidang, will be used as a case study. The geometric design of highways affects the physical aspects of the highway, such as cross-sectional elements, visibility, alignment, curves, superelevations, and other related features. A line is a straight path that connects two or more points (Kamble, et al., 2022). The horizontal

alignment designates the bends in the roadway, while the vertical alignment designates the shape of the road's ascents and descents. The two alignments are related to one another because the road designed is a three-dimensional component which is a combination of horizontal and vertical components.

Therefore this paper aims to design geometric roads using AutoCAD® Civil 3D Jalan Raya Lewikidang along 2 km Majalengka. With full hope that this access can provide comfort for the surrounding community and the people who cross the road.

2. Literature Riview

2.1 Highway

Roads have an important role in life, including facilitating the circulation and distribution of service goods (Subkhan, 2019). Road infrastructure that is good and smooth will be fulfilled if the geometric technical requirements of the road have been fulfilled (Kaharu, Lalamentik, & Manoppo, 2020).

Road construction is a form of government effort to facilitate timely economic and social mobility of the Indonesian people (Rizki, Rifai, & Djamal, 2022). As time goes by, developments will continue to increase, one of which is land transportation, such as motorized vehicles and four-wheeled vehicles. The need for land transportation services is increasing to facilitate the movement of people and goods and to function as Regional Development Growth (Fauzan, Thoriq, Arif, & Wicaksono, 2016).

Local Road Is a public road that is used to serve vehicles traveling short distances. Local roads themselves are divided into two parts, namely primary local roads and secondary local roads. Primary local roads have the criteria of short driving distances, a low average speed of 20 km/hour, and an unlimited number of lanes (Lubis, Tarigan, Suharamadhan, & Batubara, 2022). Whereas secondary local roads have a minimum design speed criterion of 10 km/hour, the width of the road is not intended for three-wheeled vehicles or more, a minimum of 3.5 meters (Michael, 2022).

2.2 Road Geometric

Road geometric planning is very important in the construction of existing roads. Section of the road according to No. 38 of 2004 concerning highways, road sections, visibility, horizontal and vertical alignment (Rambitan, Lalamentik, & Sendow, 2022) Road geometry greatly affects the smooth flow of traffic or even wrong planning will endanger traffic safety (Samsudin, 2019). Therefore, it is necessary to design a geometric road so that it can fulfill the basic function of the road which provides optimal comfort for the flow of traffic according to the planned speed.

Road geometric design involves the physical layout as seen from the road, including factors such as cross sections, visibility, alignment, curves, and superelevations (Veer, Gupte, & Juremalani, 2018). The highway geometry elements are obtained through several analyzes and calculations that are selected and positioned in such a way that the road planning criteria are met (Mandal, Pawade, Sandel, & Infrastructure, 2019).

As for aspects that must be considered such as visibility, sufficient space, and adequate surface friction coefficient, economical and efficient, and easy implemented, providing a uniform physical infrastructure regarding the type of road terrain tersebut (Agniya, Rifai, & Taufik, 2022) . The geometric design of roads is generally carried out with the help of design software that only utilizes images in 2D form, while the design calculations are carried out manually based on the 1997 Highways Road Geometric Planning Procedures.

2.3 AutoCAD Civil 3D

AutoCAD 2020 software includes industry-specific tools, improved workflows across desktop, web,

and mobile, and new features like the Blocks palette. The ability to simulate all the information in a development project into a 3D model allows for efficient and highly accurate planning in less time (Faisal, Lulusi, & Sanra, 2021).
AutoCAD is a design builder used by architects, engineers and construction professionals to create precise 2D and 3D drawings. The rapid development of information technology has also become one of the supporting factors for realizing the above idea, which involves the concept of 3D modeling and simulation (Budisusanto & Rozi, 2019).

3. Research Methods

This study discusses road alignment and alignment planning. This includes cross sections, longitudinal sections, and other aspects related to the physical shape of the road. The geometric design itself includes horizontal alignment and vertical alignment, this study is a determinant of the level of comfort and safety produced by road geometry. This research method uses quantitative methods. The data used in this study are primary. The primary data of this research includes horizontal and vertical alignment. The geometric design of this road uses the AutoCAD® Civil 3D application. The research location is in Indonesia, West Java Province, Majalengka Regency, to be precise, on Jalan Raya Leuwikidang as shown in the image below.

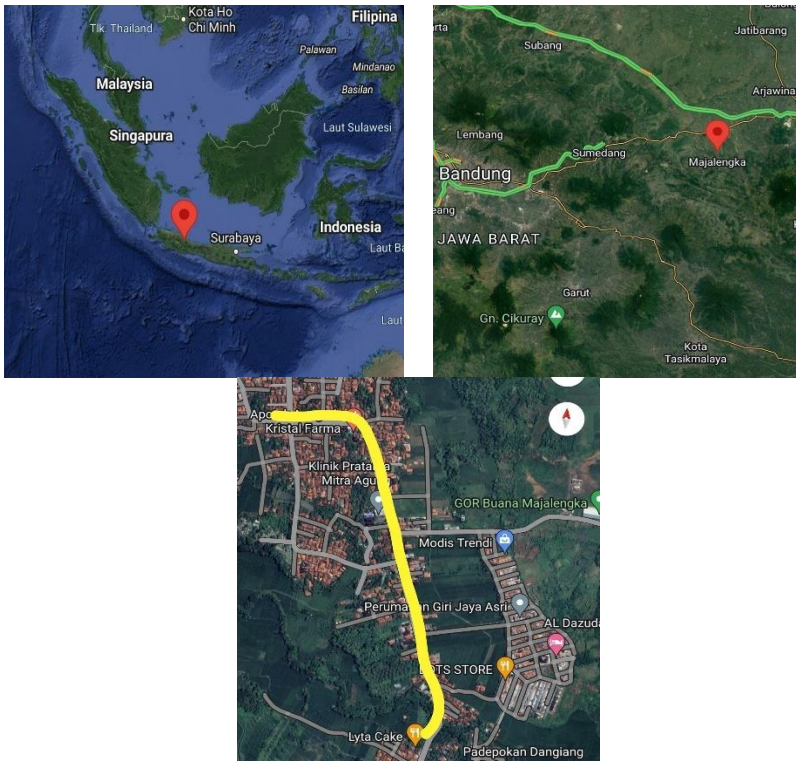

Figure 1 Leuwikidang Highway Research Location

4. Discussion

Based on the planning for Jalan Raya Leuwikidang Majalengka, the planning results obtained include, the selection of road alignment, horizontal alignment, vertical alignment.

4.1 Horizontal Alignment

Table 1 Horizontal Alignment

NO	TIKUNGAN	R	β	VR	TS	LT	Es	e	Ls	Lc	P	K	Jenis Tikungan
1	PI 1	119	96.7	60	158.09	249.2	60.1	3.4	50	149.2	0.9	24.9	SCS
2	PI 2	119	57.7	60	91.4	170.4	18	3.4	50	70.4	0.9	24.9	SCS

As can be seen from the summary table above, in horizontal linear planning, the PI 1 and PI 2 curves are both spiral-circle-spiral. Parameter values for the intermediate asphalt content (Pb) with the number of collisions of 2×75. The amount of road widening at a bend depends on the standard size of the planning plan, the turning radius (R) and the speed of the planning plan must comply with the Bina Marga planning standards.

4.2 Vertical Alignment

NO	STA PLV	STA a	STA PTV	LV	ELEVASI	g1	g2	Ev
1	22+615	22+625.5	22+690	150	1594.4	-0.3	-3.2	0.533
2	22+805	22+842.5	22+880	150	1588.6	-3.2	-5.03	0.375

Figure 2 Vertical Alignment

In planning vertical alignment, the author always pays attention to the elevation of the vertical alignment so that it is not too high or too low with the original ground level, so that the excavation and filling (incubation) work is more effective. In addition, another aspect that must be considered here is the percentage of ascents and descents, because it can be seen from the table that the percentage (%) of ascents and descents planned by the author is relatively small, this is done to further increase the driver's comfort while driving.

4.3 Suprelevation

No	Road Elevation	Ls' (Fiktif)	EKB In	EKB Middle	EKB Out	e maks
PI 1	1598	38	1597.89	1597.97	1598.1	10%
PI 2	1580	38	1579.89	1579.97	1580.1	10%

Figure 3 Superelevation

The slope of the curve is to withstand the centrifugal force generated when the vehicle turns, the smaller the design radius, the greater the slope. emaks) at the corner of the road.

4.4 Jph Recaptulation

No	d1 0,278 x v x t	d2 v2 254 x fm	d_{Jph} d1+d 2
PI 1	41.7	92.6	134.3
PI 2	41.7	92.6	134.3

Figure 4 Jph Recapitulation

It can be seen from the table that the results of d1, d2 and djph all equal angles fulfill the conditions djph > dmin. Overtaking visibility is the distance required for the driver to pass other vehicles safely. For this plan, the speed traveled is 15 km/hour.

4.5 Rekaptulasi jpm

No	t1 2.12+0.026 V	t2 6.56+0,048 V	A 2.052+0.036 V	d1 0.278 x tl (V-m a t)	d2 0.278 x V x t2	d3 (30 m-100 m)	d4 2/3 d2	d Jpm d1+d2+d3+d4
PI1	3.68	9.44	2.268	50.3	175.4 5	30	104.9	342.73
PI2	3.68	9.44	2.268	51.3	175.4 5	30	104.9	342.73

Figure 5 Jpm Recaptulation

It can be seen from the results table d1, d2, d3, d4 and djph that all angles are the same, meeting the requirements djpm > dmin. The superelevation calculation at a bend describes the length of space required to change the cross slope (superelevation) from normal superelevation to full superelevation.

4.6 Bend

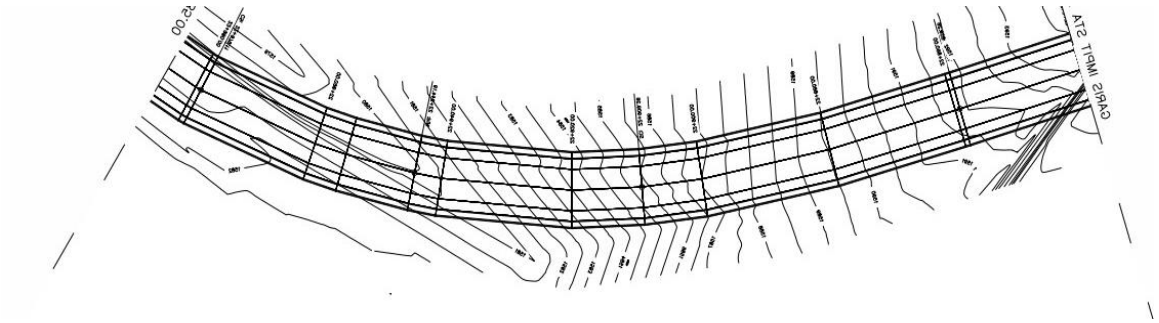

Figure 6 Bend 1

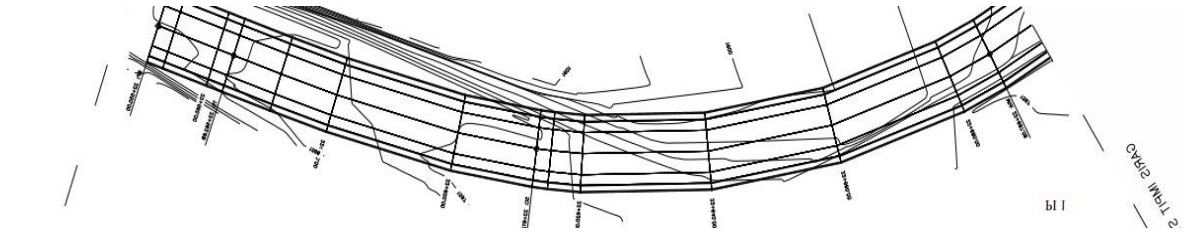

Figure 7 Bend *2*

5. Conclusion

The results of the discussion can be summarized as a geometric design for Jalan Raya Leuwikidang using Autocad® Civil 3D. The design process utilizes Autocad® Civil 3D by displaying some of the data we need, starting from horizontal alignment, vertical alignment, superelevation, jph recap and jpm recap.

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