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Geometric Design for Damar Wulan Road Deli Serdang Regency

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ABSTRACT

Damar Wulan Road is one of the 3.5 km road sections located in Sampali Village, Percut Sei Tuan District, Deli Serdang Regency. This road has the potential to be an access to a strategic location, but there are still few people who use Damar Wulan Road as a mobilization route because most of the road is still subgrade. Therefore, it is necessary to design the Damar Wulan Road so that it can be used by the community. This study aims to design vertical alignment for Damar Wulan Road. The method used for vertical alignment design is TPGJAK 1997. The calculation on the vertical alignment obtained results in the form of 16 PVI arches, which are 8 convex vertical curves and 8 concave vertical curves.

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1. INTRODUCTION

Roads and complementary buildings are infrastructure for land transportation modes. Roads are very important infrastructure for mobility, survival, and improvement of the community's economy. The need for economic continuity, mobility, and connectivity makes Jalan Damar Wulan an infrastructure for land transportation modes that must be considered. Jalan Damar Wulan is one of the 3.5 km long roads located in Sampali Village, Percut Sei Tuan District, Deli Serdang Regency. This road section has the advantage that it can provide direct access to Jalan Medan-Sampali, Jalan H. Anif and strategic locations around it. For example, the H. Anif 2 toll gate, Jalan Pancing, Jalan Cemara, Jalan Williem Iskandar, and others. However, there are still a few people who use Jalan Damar Wulan as access in and out of the community because most of the road is still in the form of subgrade.

In road planning, the geometric shape of the road must be determined in such a way that the road in question can provide optimal service to traffic flows according to its function[1]. Vertical alignment is defined as the projection of the axis of the road on the vertical plane, in the form of a longitudinal cross section of the road[2]. Vertical alignment is also known as longitudinal section or road profile. The function of the vertical alignment is to reduce shock due to changes in slope, providing stopping visibility, comfort, and comfort for road users.

With the design of Jalan Damar Wulan, it is hoped that it will increase the ease of mobility and the economy of the rural communities that the road passes through. This study aims to make a geometric design in the form of a vertical alignment using the 1997 TPGJAK method.

2. RESEARCH METHOD

a. Research location

A The research was conducted on Damar Wulan Street, Deli Serdang Regency.

b. Data Collecting Technique

Elevation data collection is carried out through a direct survey at the research site using an automatic level device with a stationing distance of every 50 meters [3].

c. Data Analysis Technique

Procedure for calculating vertical alignment using the TPGJAK 1997 method[4].

The vertical alignment calculation procedure is presented in Figure 1.

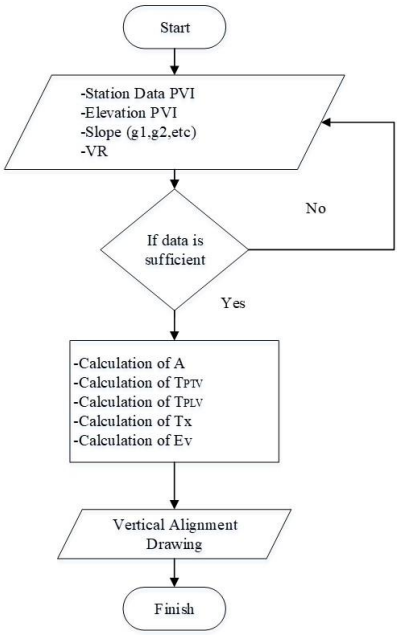

Figure 1. Procedure of Alignment Vertical Calculation

3. RESULTS AND ANALYSIS

3.1. Data processing result

The data that has been obtained from the field is in the form of original ground elevation data every 50 meters, then the data is processed so that the location of the Point of Intersection (PVI) points can be planned. The vertical curve plan data on the Damar Wulan Road section, Deli Serdang Regency based on the plan drawings are presented in Table 1.

Table 1. Elevation and slope data for every point of vertical intersection (PVI)

Point	STA (m)	Elevation (m)	Elevation Difference (m)	Distance (m)	g	Slope (g%)
A	600	99,5				
PVI 1	650	100,201	0,701	50	g1	1,40
PVI 2	769,92	99,844	-0,357	119,92	g2	-0,30
PVI 3	1000	100,2	0,356	230,08	g3	0,15
PVI 4	1350	99,657	-0,543	350	g4	-0,16
PVI 5	1500	100	0,343	150	g5	0,23
PVI 6	1739,92	99,248	-0,752	239,92	g6	-0,31
PVI 7	2000	100	0,752	260,08	g7	0,29
PVI 8	2269,92	98,679	-1,321	269,92	g8	-0,49
PVI 9	2559,92	98	-0,679	290	g9	-0,23
PVI 10	2800	98,869	0,869	240,08	g10	0,36
PVI 11	2850	98,64	-0,229	50	g11	-0,46
PVI 12	3000	99,516	0,876	150	g12	0,58
PVI 13	3050	99	-0,516	50	g13	-1,03

PVI 14	3150	99,164	0,164	100	g14	0,16
PVI 15	3239,92	98,82	-0,344	89,92	g15	-0,38
PVI 16	3379,68	99,162	0,342	139,76	g16	0,24
B	3500	98,791	-0,371	120,32	g17	-0,31

3.2. Point of vertical intersection calculation (PVI)

The calculation of the vertical curve of PVI_1 is as follows:

g_1 = +1,40 %
g_2 = -0,30 %
Vr = 60 km/h
Elev.TPVI = 100,201

A = $g_2 - g_1$ = -1,70 %
Lv = 40 m
TPTV = $TPVI - g_1 \times \frac{Lv}{2}$
= $100,201 - (1,40\ \%) \times \frac{40}{2}$
= 99,921 m
TPLV = $TPVI + g_2 \times \frac{Lv}{2}$
= $100,201 + (-0,30\ \%) \times \frac{40}{2}$
= 100,141 m
Tx = $TPTV + g_1 \times X + Y$
Dimana: Y = $\frac{A}{200\ Lv} \times x^2$

Tx calculations are presented in Table 2.

Tabel 2. Tx calculations for PVI_1

X	g1*X	X2	Y=	A/200Lv*X2	Tx
0	0,000	0		0,000	99,921
5	0,070	25		-0,005	99,985
10	0,140	100		-0,021	100,040
15	0,210	225		-0,048	100,083
20	0,280	400		-0,085	100,116
25	0,350	625		-0,133	100,138
30	0,421	900		-0,191	100,150
35	0,491	1225		-0,260	100,151
40	0,561	1600		-0,340	100,141

Ev = A x Lv/800 = -0,085 meter (convex curve)

The sketch for PVI_1 shown in figure 2.

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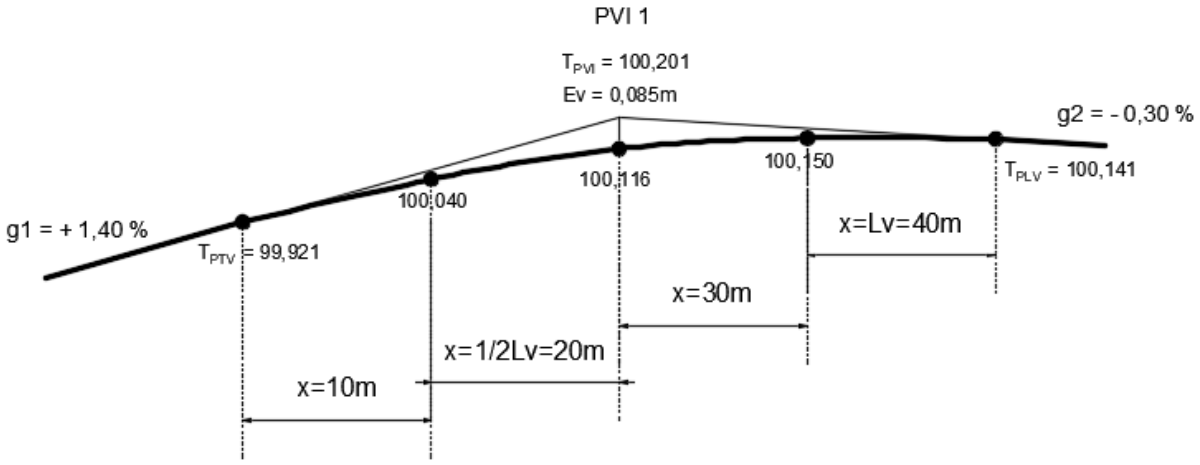

Figure 2. PVI_1 sketch drawing

3.3. Final result for all PVI point

By using the same calculation technique as PVI_1, it is possible to obtain all the Ev values for all planned PVI points. The results of the vertical alignment design are presented in Table 3.

Table 3. Ev value for all PVI points

Point	STA (m)	g	Slope (g%)	Lv (m)	ev (m)
A	600				
PVI 1	650	g1	1,40	40	-0,085
PVI 2	769,92	g2	-0,30	40	0,023
PVI 3	1000	g3	0,15	40	-0,015
PVI 4	1350	g4	-0,16	40	0,019
PVI 5	1500	g5	0,23	40	-0,027
PVI 6	1739,92	g6	-0,31	40	0,030
PVI 7	2000	g7	0,29	40	-0,039
PVI 8	2269,92	g8	-0,49	40	0,013
PVI 9	2559,92	g9	-0,23	40	0,030
PVI 10	2800	g10	0,36	40	-0,041
PVI 11	2850	g11	-0,46	40	0,052
PVI 12	3000	g12	0,58	40	-0,081
PVI 13	3050	g13	-1,03	40	0,060
PVI 14	3150	g14	0,16	40	-0,027
PVI 15	3239,92	g15	-0,38	40	0,031
PVI 16	3379,68	g16	0,24	40	-0,028
B	3500	g17	-0,31		

Final images for all PVIs are presented in Figure 3 and Figure 4.

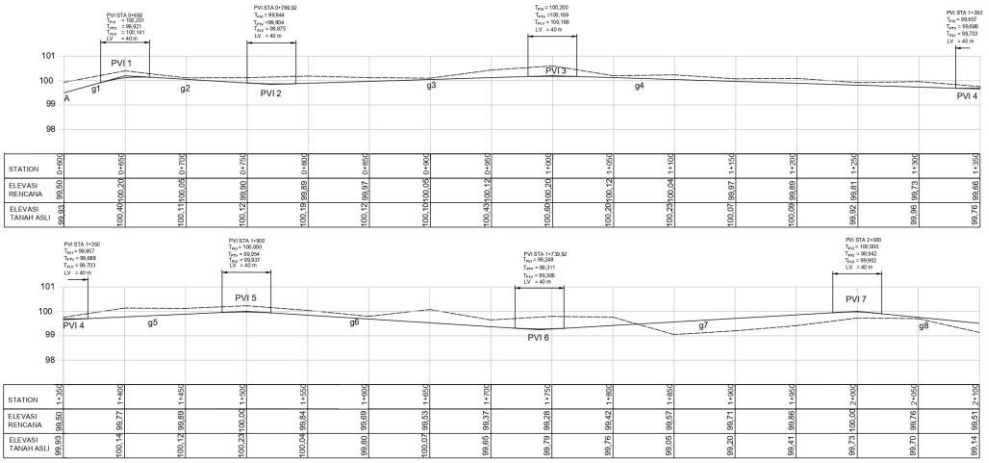

Figure 3. Final drawing of PVI_1 – PVI_7

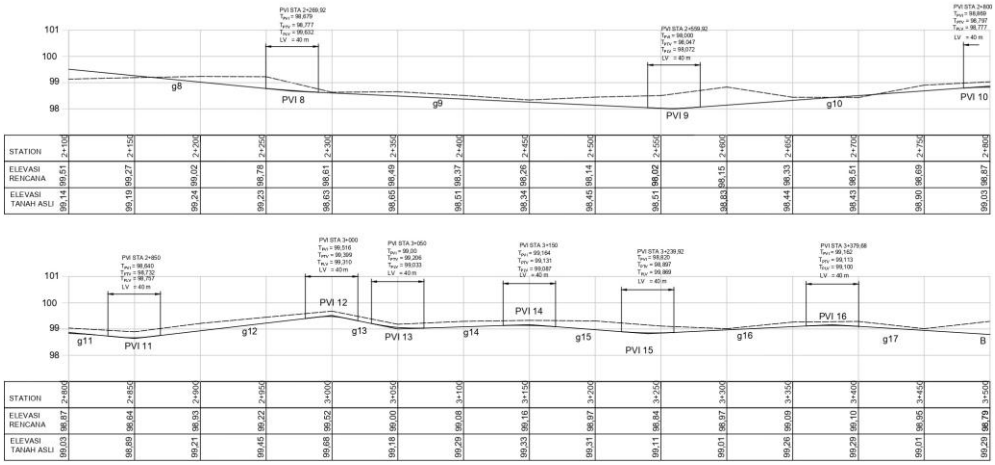

Figure 4. Final drawing of PVI_8 – PVI_{16}

4. CONCLUSION

The calculation on the vertical alignment using TPGJAK 1997 method for Damar Wulan Road, Deli Serdang Regency obtained results in the form of 16 PVI arches, which are 8 convex vertical curves and 8 concave vertical curves.

ACKNOWLEDGEMENTS

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