

Analysis of Secondary Local Road Conditions Using the Surface Distress Index (SDI) Method in Medan Amplas District

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ABSTRACT

Road network data and information and spatial supporting infrastructure are an important part of a road database management planning process. Medan Amplas District, Medan City has a road network which is divided into national authority roads, provincial roads and city roads, which is 143.14 km. The study area in this research is a flexible pavement type secondary local road with a length of 33.12 km. The method used in this research is the Surface Distress Index (SDI) Method. SDI divides road conditions into 4, namely good condition, moderate condition, lightly damaged condition and heavily damaged condition. According to RCS or SKJ 2011, there are only 4 elements that are used as support for calculating the SDI value, namely % crack area, average crack width, number of holes, and average rutting depth, from the results of the analysis of the level of road damage in secondary local roads with flexible pavement type in Medan Amplas District, namely 51 road sections in good condition (98%) and 1 road section in fair condition (2%). It can be concluded that the condition of the Secondary Local roads in Medan Amplas District is in good condition and only requires routine maintenance at certain points on each road section. The condition of the Secondary Local roads in Medan Amplas District using the SDI Method is in Good Rating, but the Denai River Inspection Road section has a rating of moderate damage.

Keywords: road condition assessment; flexible; pavement; SDI.

INTRODUCTION

The quality of a road database plan is largely determined by accurate and up-to-date road and environmental data and information regarding various sectors. In Medan Amplas District, Medan City, the total length of the road network which is divided into national authority roads, provincial roads and city roads is 143.14 km. The study area in this research is a secondary local road with a flexible pavement type with a length of 33.12 km. This research is based on a review of the 2022 Medan City RTRW, which may indicate changes in data on the length of the road network in Medan Amplas District, Medan City.

Understanding the Road

Roads are land transportation infrastructure which includes all parts of the road, including connecting buildings, complementary buildings and equipment intended for traffic, which are on the ground surface, above the ground surface, below the ground surface, and/or water, as well as above the surface. water, except for railways, lorry roads and cable roads

Road Classification

Roads can be differentiated according to their function in accordance with Law of the Republic of Indonesia Number 2 of 2022 concerning the Second Amendment to Law Number 38 of 2004 concerning Roads, namely Arterial Roads, Collector Roads, Local Roads, Environmental Roads.

Road Group

Road grouping is intended to provide legal certainty for road operators in accordance with the authority of the central government and regional governments. Road groups according to their development authority are in accordance with Law of the Republic of Indonesia Number 2 of 2022

concerning the Second Amendment to Law Number 38 of 2004 concerning Roads, namely National Roads, Provincial Roads, Regency Roads, City Roads, Village Roads.

Types of Road Damage

Based on the Circular Letter of the Minister of PUPR Number 19/SE/M/2016 concerning Determination of the Pavement Condition Index (IKP), road damage consists of asphalt concrete damage and rigid concrete damage, asphalt concrete pavement consists of 20 damages.

Table 1. Types of road damage

No	Asphalt pavement damage
1	Fatigue cracking
2	Bleeding
3	Block cracking
4	Bumps and sags
5	Corrugation
6	Depression
7	Edge cracking
8	Joint reflection cracking
9	Lane/shoulder drop off
10	Longitudinal and transverse cracking
11	Utility excavation patches and patches
12	Polished aggregate
13	Holes
14	Railroad crossings
15	Rutting
16	Shoving
17	Slippage cracking
18	Swell
19	Ravelling
20	Surface wear

Surface Distress Index (SDI)

SDI (Surface Distress Index) is a system for assessing road pavement conditions based on visual observations and can be used as a reference in maintenance efforts. In implementing the SDI method, road sections will be surveyed and divided into segments.

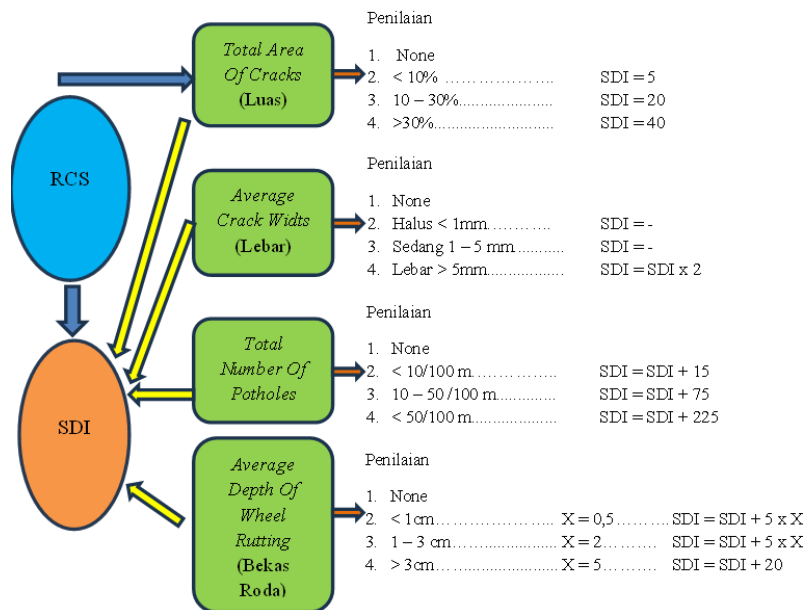


Figure 1. Calculation of SDI for Asphalt Roads (Bina Marga, 2011) (Number 13/PRT/M/2011 Concerning Procedures for Road Maintenance and Surveillance, 2011)

Table 2. Road Condition Assessment Based on SDI Values (Bina Marga, 2011)

No	SDI value	SDI value (c)
1	< 50	Good
2	50 - 100	Currently
3	100 - 150	Light Damage
4	> 150	Heavy Damaged

RESEARCH METHODS

Research Location

This research was carried out on secondary local roads with flexible pavement type, Medan Amplas District, Medan City. The road sections reviewed from 52 roads have a total length of 33.12 km and an average pavement width of 3 meters. The following is a data table and map of the research location

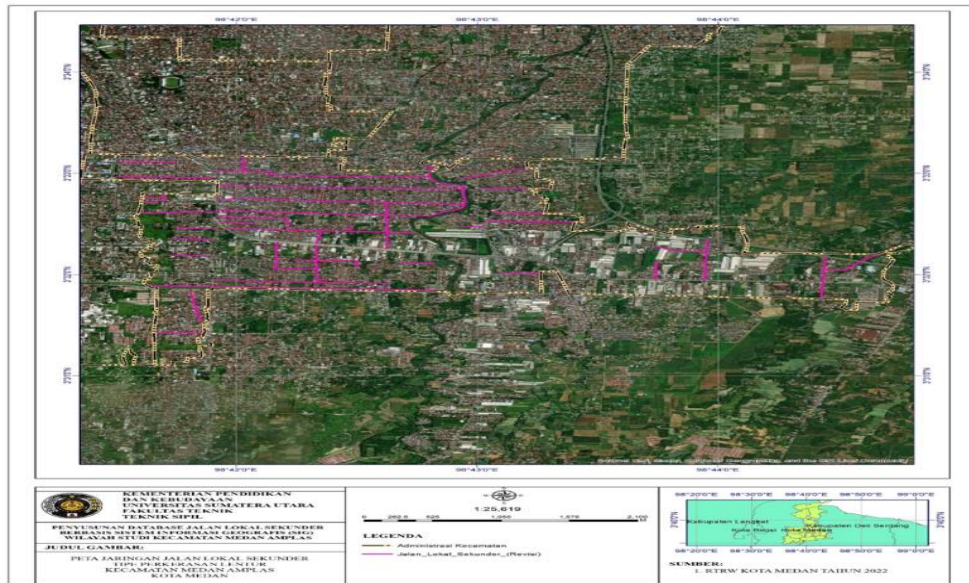


Figure 2. Research Location

Research methods

The research method used consists of several methods, namely the SDI method.

Research Stages

The entire activity of this study can be described in the research flow chart in Figure 3.

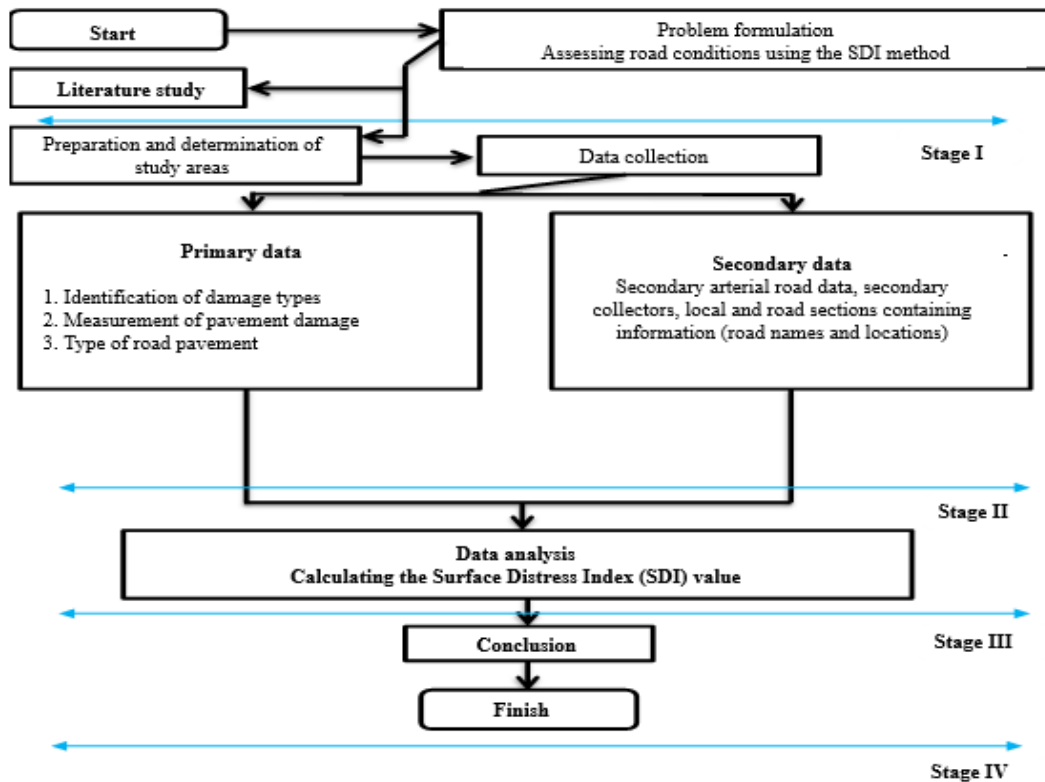


Figure 3. Research flow chart

RESULTS AND DISCUSSIONS**Analysis of Surface Distress Index (SDI) Values**

The following is the calculation of the Surface Distress Index (SDI) assessment for Jalan Pelita, Medan Amplas District, Medan City, where the entire calculation of the SDI value for Secondary Local Roads for Flexible Pavement Type can be seen in Appendix A.

1. Determine the SDI1 value based on the total area of cracks (Total Area of Cracks) through calculations using the following data:
 - a. Segment lane width = 2.7 Meters
 - b. Length of road segment = 100 m
 - c. Segment area = 2.7 m x 100 m = 270 m²

For the calculation example, stationing 0+000 – 0+100 is taken on the Jalan Pelita section where the total crack area is 0.005 m², so the crack area presentation for this segment is <10%. Then the value of SDI1 = 5

2. Determine the SDI2 value based on the average crack width (Average Cracks Width) then accumulate it with the SDI1 value. For the average crack width at stationing 0+000 – 0+100, namely 1-5 mm wide, then the SDI2 value = 5.
3. Determine the SDI3 value which is also the result of the accumulation of the SDI2 value based on the number of holes (Total of Potholes) found at stationing 0+000 – 0+100 which is then multiplied by 10. An example of a calculation based on the number of holes is as follows:
 - a. Number of holes = 3 pieces
 - b. Total number of holes = 3 pieces
 - c. SDI2 value = 5

Based on the criteria that have been determined for the number of holes, the value SDI3 = 20 is obtained

4. Determine the final SDI4 or SDI value based on the decrease due to rutting which is then accumulated with the SDI3 value. At stationing 0+000 – 0+100, rutting value = 3 cm. Based on the criteria set for a rut depth of 1 – 3 cm, the value obtained is SDI = SDI3 + 10 = 20 + 10 = 30 (Good).

The results of the calculation of secondary local conditions can be seen in Appendix B. The following is a recapitulation of the calculation of the SDI value for Local Secondary Roads:

Table 3. Secondary Local Road Damage Level Values

No	Road section name	Road length (km)	SDI	Deterioration level
1	Jalan Pelita	0,26	16,67	Good
2	Jalan Inspeksi Sungai Denai	1,30	66,35	Medium
3	Jalan Pendidikan	0,72	0,00	Good
4	Jalan Sumber Utama II	1,71	12,50	Good
5	Jalan Martoba I	0,32	0,00	Good
6	Jalan Dame	0,73	1,88	Good
7	Jalan Selamat Timur	0,21	0,00	Good
8	Jalan Bajak III	0,48	9,00	Good
9	Jalan Garu V	0,21	0,00	Good
10	Jalan Syukur	0,44	0,00	Good
11	Jalan Garu VII	0,24	0,00	Good
12	Jalan Tuar	0,40	3,75	Good
13	Jalan Bajak IV Timur	0,42	15,00	Good
14	Jalan Cengkeh	0,34	7,50	Good
15	Jalan Selamat	1,50	6,00	Good
16	Jalan Garu VIII	0,62	0,00	Good
17	Jalan Bajak IV	0,67	0,00	Good
18	Jalan Garu IV	0,68	4,29	Good
19	Jalan Asrama II	0,30	0,00	Good

No	Road section name	Road length (km)	SDI	Deterioration level
20	Jalan Suka	0,27	10,00	Good
21	Jalan Suka Ria	0,18	7,50	Good
22	Jalan Bendungan II	0,29	0,00	Good
23	Jalan Panca	0,30	0,00	Good
24	Jalan Bilal/Garu VI	1,33	2,86	Good
25	Jalan Bajak II H	1,36	4,29	Good
26	Jalan Bendungan IV/Perkebunan	0,35	0,00	Good
27	Jalan Pengilar	0,72	7,50	Good
28	Jalan Bajak IV Barat	0,16	0,00	Good
29	Jalan Sumber Utama I	0,52	7,50	Good
30	Jalan Garu II	1,92	3,00	Good
31	Jalan Bajak I	0,57	14,17	Good
32	Jalan Sumber Amal	0,38	3,75	Good
33	Jalan Saudara	0,30	0,00	Good
34	Jalan Suka Makmur	0,13	15,00	Good
35	Jalan Balai Desa	0,43	6,00	Good
36	Jalan Perbatasan	0,75	0,00	Good
37	Jalan Manurung	0,44	6,00	Good
38	Jalan Pembangunan	0,74	2,14	Good
39	Jalan Makmur	0,24	0,00	Good
40	Jalan Tengah	0,54	2,50	Good
41	Jalan Pabrik Soda/Seser	0,19	15,00	Good
42	Jalan Bendungan I	0,44	0,00	Good
43	Jalan Selambo	0,60	7,50	Good
44	Jalan Gereja	0,30	5,00	Good
45	Jalan Sejahtera	0,25	10,00	Good
46	Jalan Garu I	1,88	1,58	Good
47	Jalan Garu III	1,63	2,35	Good
48	Jalan Bendungan V/Damai	0,53	0,00	Good
49	Jalan Luka	0,53	5,00	Good
50	Jalan Kakak Tua	1,00	15,00	Good
51	Jalan Garu X	1,00	15,00	Good
52	Gang Suka Bakti	1,30	15,00	Good

From the data above, it can be concluded that the percentages obtained from the assessment of Secondary Local Roads using the Surface Distress Index (SDI) method are as follows:

Table 4. Percentage of Number of Levels of Secondary Local Road Damage

No	Deterioration level	Total	Percentage
1	Good	51	98%
2	Medium	1	2%
3	Minor damage	0	0%
4	Major damage	0	0%

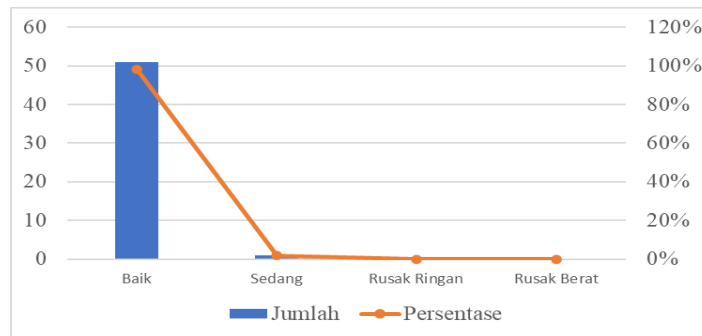


Figure 4. Barchart of Road Damage Levels

The level of road damage on Secondary Local Roads in Medan Amplas District is 98% (51 secondary local roads) in good condition and 2% (1 secondary local road) in fair condition. It can be concluded that the condition of the Secondary Local roads in Medan Amplas District is in good condition and only requires routine maintenance at certain points on each road section.

Road Data Differences

From the results of the secondary local data survey, Medan Amplas District, Medan City, it is known that there are several road sections that have different road lengths from the data received by the Medan City Bappeda and data in the field. Field data for the length of the Border Road is 0.75 km, while secondary data obtained is data for the length of the Border Road is 0.59 km. Here there are data anomalies that are not in line with the conditions in the field. The following are differences in data that occur in the field.

Table 5. Differences in Road Length

No	Road section name	Length of the road	
		Primary data	Secondary data
1	Jalan Perbatasan	0,75	0,59
2	Jalan Sumber Utama I	0,52	0,53
3	Jalan Inspeksi Sungai Denai	1,30	1,16
4	Jalan Balai Desa	0,43	0,45
5	Jalan Dame	0,73	0,68
6	Jalan Bendungan II	0,29	0,30
7	Jalan Bendungan IV (Perkebunana)	0,35	0,07
8	Jalan Bendungan I	0,43	0,44
9	Jalan Sumber Utama II	1,71	1,80
10	Jalan Bajak IV	0,67	0,69
11	Jalan Bajak III	0,48	0,49
12	Jalan Garu VI	1,33	1,24
13	Jalan Garu X	0,10	0,00
14	Jalan Garu VIII	0,62	0,52
15	Jalan Garu VII	0,24	0,25
16	Suka Bakti	0,13	0,36
17	Suka Makmur	0,13	0,19

Liminity Surface Distress Index (SDI) Method

Limitation of Damage Level calculations using the Surface Distress Index (SDI) method, namely there is a calculation of the number of holes in the SDI calculation. Meanwhile, in field conditions, if only the number of holes is calculated, according to the author, it does not have a significant effect on the calculation of the damage value. For example, there is a case on the Sungai Denai Inspection

CONCLUSION

Condition of local secondary roads with flexible pavement type in Medan Sandpaper District using the SDI method, namely 51 road sections (98%) in Good Rating, 1 road section (2%) rated as medium level of damage.

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