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Analysis of Sustainable Road Assessment in South Sumatera using Fuzzy Weighted Average (FWA) Method

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Abstract:- Sustainable development in Indonesia continues to grow with the aim to realize the ideal and environmentally friendly road construction, and to optimize the area around the road as a good water absorption region. The purpose of this study is to conduct assessment of sustainable roads in the South Sumatra Region of Indonesia, especially the National Road. The study was conducted by developing sustainable road assessment using the fuzzy theory. The road assessment was analyzed by developing the FSRI (Fuzzy Sustainable Road Index) program using the Fuzzy Weighted Average (FWA) operation, to get a sustainable road index value for selected sustainable road indicators. The results of the assessment were then compared with the assessment using the AHP method. The results show that road assessments using FWA operation produces an assessment that is in line with AHP assessment results. However, the results of assessments with FWA operation is better at interpreting results because it uses numerical value and linguistic term. Overall, the assessment result of the sustainable road on national roads in the South Sumatra region are stated with a 'good' linguistic rating term and dominated by 'fair' linguistic rating term.

Keywords:- *Assessment, Aspect and Indicator, Sustainable Road, Fuzzy Weighted Average..*

I. INTRODUCTION

Sustainable road assessment can realize a road construction which is ideal and environmentally friendly and can optimize the area around the road as a good water absorption region. From 2015 to 2017, the formulation of aspects until the formulation of green road assessment indicators were done to encourage sustainable project implementation in road construction activities by the Indonesian Road Research and Development Center [1].

Sustainable road assessment can be done by rating and weighting methods to obtain a road value on each aspect and indicator. Suprayoga [2] conducted a green road assessment using the AHP method to determine the weight in the subcategory of Indonesia's green road rating. The assessment system with AHP depends on the subjective perception of experts. In the road assessment that involves the subjectivity of experts, the use of fuzzy theory can provide better results to overcome judgments that have uncertainty from the expert's perceptions [3],[4],[5],[6]. A. R. Hemdi, et al. [7] In this study, the fuzzy theory was used to overcome qualitative and quantitative data by showing that the sustainability evaluation method using the fuzzy theory can reduce the complexity involved in decision making. Fuzzy theory also has advantages in the process of reasoning in language (linguistic), is flexible, and can develop and apply the experience of experts directly, without having to go through a training process.

The purpose of this study is to develop a sustainable road assessment using Fuzzy Weighted Average operation and compare the results of the sustainable road assessment analysis with the existing assessments..

II. RESEARCH METHODOLOGY

A. Data Collection

The data used in this study consists of sustainable road indicators selected based on their conformity to Indonesia's green road indicators which can be seen in Table 1, the results of experts' opinions on range values, the linguistic rating shown in Table 2-6, and weight values of each indicator shown in Table 7. Questionnaires were distributed to 30 respondents in the category of experts from academia, practitioners, and researchers, as well as experts in the fields of transportation, roads and bridges, environment, and geotechnics. Respondent criteria in this study are experts with work experience in the field of road infrastructure of at least 5-10 years with a minimum education level of Bachelor.

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The study was conducted on the Road Construction Implementation Section for the 2019 Budget Year which is currently still in the period of implementation and maintenance, namely: 1) Bts. Kota Lahat – Sp. Air Dingin – Pagar Alam – Bts. Prov. Bengkulu Roads, 2) Muara Beliti - Bts. Kab. Musi Rawas - Tb. Tinggi - Bts. Kota Lahat Roads, 3) Peninggalan – Sei. Lilin – Betung Roads, 4) Soekarno – Hatta (Palembang) Road.

TABLE 1. SUSTAINABLE ROADS INDICATORS

No	Aspect	Indicator
1	Enviromental and Drainage (L)	a. Environmental documents owned by the organization (service providers, contractors) (L1) b. Reduction of dust pollution (L2) c. Protection of habitats (L3) d. Planting plants (L4) e. Channel system (L5)
2	Social and Access Availability (S)	a. Facilities and infrastructure for pedestrians, cyclists and public transportation (S1) b. Geometric planning and supporting facilities (S2) c. Occupational Health and Safety (S3) d. Community participation (S4) e. Street ornaments and landscape (S5)
3	Construction Implementation (K)	a. Completeness of general management system documents (K1) b. Emission reduction (K2) c. Water management (K3) d. Energy use (K4) e. Communication between planning team and contractor (K5)
4	Material and Resources (M)	a. Reuse of old material (M1) b. Excavation and stockpile management (M2) c. Recycling materials used (M3) d. Use of local materials (M4) e. Street lighting energy management (M5)
5	Pavement Technology (T)	a. Material urilization (T1) b. Pavement design considering water flow (T2) c. Hot mix asphalt (T3) d. Cold mix asphalt (T4) e. Sound-reducing pavement design (T5)

TABLE 2. RANGE VALUE OF ASPECT 1

Linguistic terms	Range value				
	Indicator				
	L1	L2	L3	L4	L5
Very Good	> 84	> 85	> 81	> 82	> 87
Good	67 – 84	72 – 85	68 – 81	67 – 82	71 – 87
Fair	44 – 67	50 – 72	49 – 68	50 – 67	48 – 71
Poor	29 – 44	32 – 50	32 – 49	32 – 50	30 – 48
Very Poor	< 29	< 32	< 32	< 32	< 30

TABLE 3. RANGE VALUE OF ASPECT 2

Linguistic terms	Range value				
	Indicator				
	S1	S2	S3	S4	S5
Very Good	> 80	> 80	> 82	> 80	> 75
Good	65 – 80	65 – 80	66 – 82	62 – 80	59 – 75
Fair	44 – 65	47 – 65	49 – 66	44 – 62	41 – 59
Poor	28 – 44	30 – 47	32 – 49	27 – 44	24 – 41
Very Poor	< 28	< 30	< 32	< 27	< 24

TABLE 4. RANGE VALUE OF ASPECT 3

Linguistic terms	Range value				
	Indicator				
	K1	K2	K3	K4	K5
Very Good	> 86	> 80	> 78	> 77	> 84
Good	70 – 86	67 – 80	64 – 78	61 – 77	70 – 84
Fair	51 – 70	44 – 67	44 – 64	42 – 61	50 – 70
Poor	30 – 51	25 – 44	24 – 44	23 – 42	30 – 50
Very Poor	< 30	< 25	< 24	< 23	< 30

TABLE 5. RANGE VALUE OF ASPECT 4

Linguistic terms	Range value				
	Indicator				
	M1	M2	M3	M4	M5
Very Good	> 79	> 78	> 80	> 80	> 76
Good	67 – 79	63 – 78	65 – 80	66 – 80	62 – 76
Fair	51 – 67	48 – 68	48 – 65	47 – 66	43 – 62
Poor	30 – 51	29 – 48	29 – 48	31 – 47	24 – 43
Very Poor	< 30	< 29	< 29	< 31	< 24

TABLE 6. RANGE VALUE OF ASPECT 5

Linguistic terms	Range value				
	Indicator				
	T1	T2	T3	T4	T5
Very Good	> 80	> 82	> 77	> 80	> 77
Good	65 – 80	66 – 82	61 – 77	65 – 80	61 – 77
Fair	46 – 65	45 – 66	40 – 61	44 – 65	40 – 61
Poor	31 – 46	29 – 45	25 – 40	28 – 44	23 – 40
Very Poor	< 31	< 29	< 25	< 28	< 23

TABLE 7. WEIGHT ASSESSMEN OF EACH INDICATOR

Aspect	Sustainable road indicator weights				
	Indicator				
	1	2	3	4	5
Environmental and drainage	VI	VI	I	EI	VI
Social and access availability	VI	VI	VI	VI	I
Construction implementation	VI	VI	VI	VI	VI
Materials and resources	VI	VI	VI	EI	VI
Pavement technology	I	EI	VI	EI	VI

EI = extremely important; VI = very important; MI = moderately important; I = important; NI = not important.

B. Methodology

Data were analyzed using the fuzzy theory, namely the Fuzzy Weighted Average operation. Analysis was conducted to obtain the magnitude of the road index for each indicator of sustainable roads in the South Sumatra Region.

Analysis with the help of the FWA generated an assessment in the form of numerical rating and linguistic rating term. Next, the analysis results would be compared to the calculation results using the AHP method.

1) Development of road assessment using the fuzzy theory

Assessment of indicators was conducted by the weighting and a linguistic rating term which consists by 5 (five) categories, represented by each letter, i.e.: (A) "very good" / extraordinarily important (EI); (B) "good" / very important (VI); (C) "fair" / important (I); (D) "poor" / moderately important (MI); and (E) "very poor" / not important (NI).

Road assessments can be directly classified into the appropriate linguistic ranking based on the results of the expert's assessment of the range value, linguistic rating, and weight of each indicator. The final results of the assessment require the value of the membership function of each fuzzy set as a representative of the linguistic ranking. The membership function used in this study can be seen in Table 8 and the graphic form can be seen in Fig. 1 [8].

TABLE 8. MEMBERSHIP FUNCTION (MF) OF FUZZY SET THAT REPRESENTS LINGUISTIC RATING TERM AND WEIGHT VALUE

Linguistic term and weight	Membership Function (MF) of each f(x)	*TFNs*
A	$0.75 \leq x \leq 1.00$	1.00 ; 0.75 ; 1.00 ; 0.88 ; 1.00
B	$0.50 \leq x \leq 0.75$ $0.75 \leq x \leq 1.00$	1.00 ; 0.50 ; 0.88 ; 0.63 ; 0.75
C	$0.25 \leq x \leq 0.50$ $0.50 \leq x \leq 0.75$	0.75 ; 0.25 ; 0.63 ; 0.38 ; 0.50
D	$0.00 \leq x \leq 0.25$ $0.25 \leq x \leq 0.50$	0.50 ; 0.00 ; 0. ; 0.13 ; 0.25
E	$0.00 \leq x \leq 0.25$	0.00 ; 0.25 ; 0.00 ; 0.13 ; 0.00

TFNs: Triangular Fuzzy Numbers.

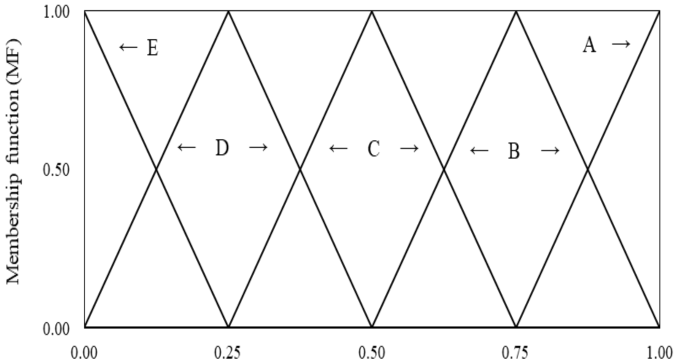

Fig. 1. Membership Function (MF) Graph

In this study, the FWA operation was used for sustainable road assessment. The vertex method [9] was used for FWA operation calculations. The FWA operation [6],[10] has a simple formula that can be seen in (1).

$$A = \frac{\sum_{i=1}^{n} A_i \times W_i}{\sum_{i=1}^{n} W_i} \quad (1)$$

Where, A = fuzzy set which represents the final assessment of conditions, Ai = fuzzy set which represents linguistic rating term, Wi = fuzzy set which represents parameter weights, and n = number of parameters used.

TABLE 9. ROAD ASSESSMENT CALCULATION RESULTS USING FSRI ON ASPECT 1

Road	L1		L2		L3		L4		L5		FSRI	α – cut distance from					LT of FSRI
	value	LT	value	LT	value	LT	value	LT	value	LT		A	B	C	D	E	
1	78	B	73	B	70	B	72	B	71	B	7.50	0.50	1.00	0.63	0.88	0.75	B
2	73	B	73	B	71	B	67	C	71	B	6.97	0.42	0.97	0.56	0.84	0.70	B
3	67	C	68	C	70	B	67	C	71	B	5.99	0.31	0.88	0.46	0.74	0.60	C
4	72	B	68	C	72	B	67	C	45	D	5.21	0.23	0.82	0.38	0.67	0.52	C
Weight	VI		VI		I		VI		EI								

LT: Linguistic Term; A: very good; B: good; C: fair; D: poor; E: very poor.

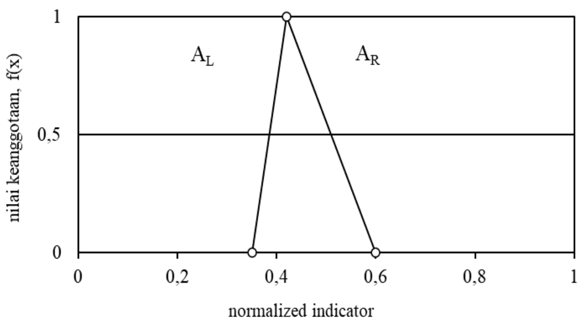

Fig. 2. FSRI Definition

Fuzzy Sustainable Road Index (FSRI) was calculated based on the final results of the fuzzy set generated from the FWA calculation. Elton index model [11] was modified and used in the final calculation using equation that can be seen in (2). Fig. 2 defined the index value of the sustainable road.

$$\text{FSRI} = \frac{A_L - A_R + 1}{2} \times 10 \qquad (2)$$

where, AL = the area approaching the left side of the MF curve; AR = the area approaching the right side of the MF curve.

The final assessment of the sustainable road is also stated in linguistic ranking. In this study, the α-level (α-cut) [6] distance method was used to translate the final results of the fuzzy set to linguistic ranking. α-level is defined on (3).

$$dj = \frac{\sum_{\alpha=0}^{1,0} \sqrt{(a_a \min - j_a \min)^2 + (a_a \max - j_a \max)^2}}{N} \qquad (3)$$

where, dj = fuzzy set between the results of fuzzy A value and fuzzy J value that have been determined; αa,min = lower limit of fuzzy set based on fuzzy A value; αa max = upper limit of fuzzy set based on fuzzy A value; ja min = lower limit of fuzzy set based on fuzzy J value; Ja max = upper limit of fuzzy set based on fuzzy J value; N = the number of fuzzy set intervals taken

Data on the assessment of sustainable roads in the South Sumatra region was obtained by distributing questionnaires to experts to assess the quality of each indicator of sustainable roads from the four National roads that have been determined. The assessment was conducted during the period of implementation and maintenance of the roads.

The FSRI calculations are exemplified in Road 1 where the results are shown in Table 9. The calculation phase is explained as follows:

a) The classification of sustainable road indicators is in accordance with the linguistic ranking, which is shown in Table 2 - 6. For the assessment of Road 1 on Aspect 1, L1 - L5 values are classified as Good. While the weights of the indicators are based on Table 7.
b) Translate the linguistic ranking and indicator weights into fuzzy sets using MF. The MF used is shown in Table 8.
c) Calculate the fuzzy set that represents each path using the FWA shown in (1). The final fuzzy set results for Road 1 are shown in Fig. 3.

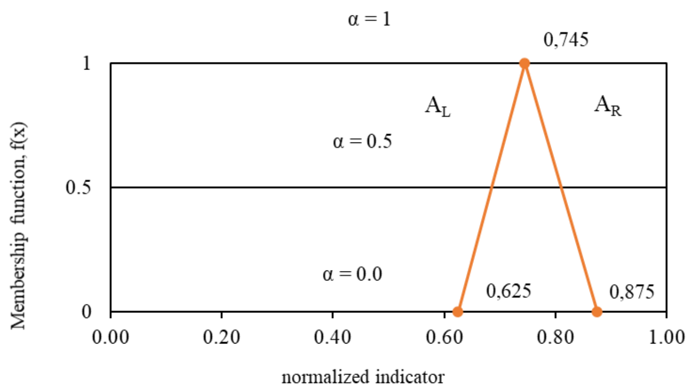

Fig. 3. Road 1 Fuzzy Set Final Score

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d) Calculate FSRI using equation that can be seen in (2) for Road 1, the calculation is:

$$A_L = \frac{1}{2} \times (0{,}625+0{,}745) \times 1 = 0.685$$

$$A_R = \frac{1}{2} \times [(1 - 0{,}875) + (1 - 0{,}745)] \times 1 = 0.190$$

$$FSRI = \frac{A_L - A_R + 1}{2} \times 10$$

$$= \frac{0{,}685 - 0{,}19}{2} \times 10$$

$$= 7.475$$

e) Translate the final fuzzy set into linguistic ranking. This process involves determining the distance from the final fuzzy set value to the fuzzy set that represents the linguistic ranking (Fig. 1) using the distance α – cut [6] method can be seen in (3). The α – cut value used were 0, 0.5, and 1.0. Table 9 shows the results of the overall road assessment on Aspect 1. The results of the assessment of sustainable roads on Aspect 2 – 5 ar shown on Table 10 – 13

TABLE 10. ROAD ASSESSMENT RESULT WITH FSRI FOR ASPECT 2

Road	**S1**		**S2**		**S3**		**S4**		**S5**		**FSRI**	**LT *Of* FSRI**
	V	**LT**	**V**	**LT**	**V**	**LT**	**V**	**LT**	**V**	**LT**		
1	64	C	72	B	66	C	60	B	58	C	6,02	C
2	68	B	64	C	71	B	62	C	58	C	6,02	C
3	66	B	63	C	64	C	61	C	56	C	5,55	C
4	64	C	46	D	61	C	44	D	39	D	3,52	D
W	I		I		I		I		I			

V: value; LT: Linguistic Term; A: very good; B: good; C: fair; D: poor; E: very poor.

TABLE 11. ROAD ASSESSMENT RESULT WITH FSRI FOR ASPECT 3

Road	**S1**		**S2**		**S3**		**S4**		**S5**		**FSRI**	**LT *Of* FSRI**
	V	**LT**	**V**	**LT**	**V**	**LT**	**V**	**LT**	**V**	**LT**		
1	75	B	67	C	63	C	60	C	69	C	5.52	C
2	72	B	64	C	60	C	58	C	67	C	5.52	C
3	74	B	64	C	62	C	60	C	69	C	5.52	C
4	69	C	62	C	59	C	58	C	66	C	5.00	C
W	VI		VI		VI		VI		VI			

V: value; LT: Linguistic Term; A: very good; B: good; C: fair; D: poor; E: very poor.

TABLE 12. ROAD ASSESSMENT RESULT WITH FSRI FOR ASPECT 4

Road	**S1**		**S2**		**S3**		**S4**		**S5**		**FSRI**	**LT *Of* FSRI**
	V	**LT**	**V**	**LT**	**V**	**LT**	**V**	**LT**	**V**	**LT**		
1	64	C	75	B	63	C	78	B	62	C	6.08	C
2	62	C	74	B	61	C	76	B	60	C	6.08	C
3	62	C	68	B	61	C	65	C	64	B	5.96	C
4	58	C	65	B	58	C	64	C	62	C	5.49	C
W	VI		VI		I		VI		EI			

V: value; LT: Linguistic Term; A: very good; B: good; C: fair; D: poor; E: very poor.

TABLE 13. ROAD ASSESSMENT RESULT WITH FSRI FOR ASPECT 5

Road	**S1**		**S2**		**S3**		**S4**		**S5**		**FSRI**	**LT *Of* FSRI**
	V	**LT**	**V**	**LT**	**V**	**LT**	**V**	**LT**	**V**	**LT**		
1	65	C	82	B	73	B	80	B	61	C	6,69	B
2	61	C	65	C	67	B	60	C	60	C	5,50	C
3	59	C	62	C	61	C	57	C	58	C	5,00	C
4	54	C	57	C	56	C	52	C	53	C	5,00	C
W	I		EI		VI		EI		VI			

V: value; LT: Linguistic Term; A: very good; B: good; C: fair; D: poor; E: very poor.

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2) Road assessment using the AHP method

In general, some steps to assess each indicator of sustainable roads using AHP are as follows [12]:

a) Making the hierarchy of sustainable roads, shown in Fig. 4;
b) Making a pairwise comparison matrix of each indicator and the results of road assessments for each Aspect, as for example in Table 14, for Aspect 1.
c) Determine the eigenvalues obtained from the calculation of the total values divided by the order of the matrices of each pairwise comparison matrix;
d) Ratio and index consistency tests that can be seen in (4) and (5).

$$CI = \frac{\lambda \max - n}{n-1} \quad (4)$$

where, CI = Deviation ratio of consistency (consistency index); λmax = The largest eigenvalue of the order matrix n; n = number of orders

If the value of consistency ratio (CR) is less than 0.100 then the assessment can be accepted, if the value is more than 0.1 then the assessment needs to be re-done [13],[14].

$$CR = \frac{CI}{RI} \quad (5)$$

where, CR = Consistency Ratio; CI = Deviation ratio of consistency (consistency indeks); RI = random index

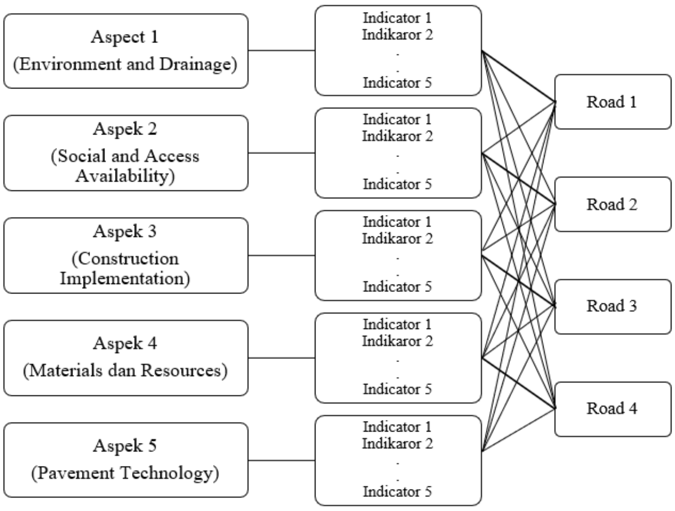

Fig. 4. The hierarchy structure of the sustainable roads

TABLE 14. MATRIX OF INDICATOR COMPARATION ON ASPECT 1

Indicator	L1	L2	L3	L4	L5
L1	1.00	3.00	2.00	3.00	3.00
L2	0.33	1.00	1.00	1.00	0.50
L3	0.50	1.00	1.00	1.00	3.00
L4	0.33	1.00	1.00	1.00	1.00

III. RESULT AND DISCUSSIONS

A. Road Assessment Using FWA

The results of road assessments for each aspect and indicator in the South Sumatra region using FSRI based on FWA operation are plotted into a radar diagram that can be seen in Fig. 5 – 8. The radar diagram shows the results of sustainable road assessments for each indicator clearly and it is easier to understand road conditions with linguistic ranking. The sustainable road rating for the four roads overall have a 'Fair' linguistic rating.

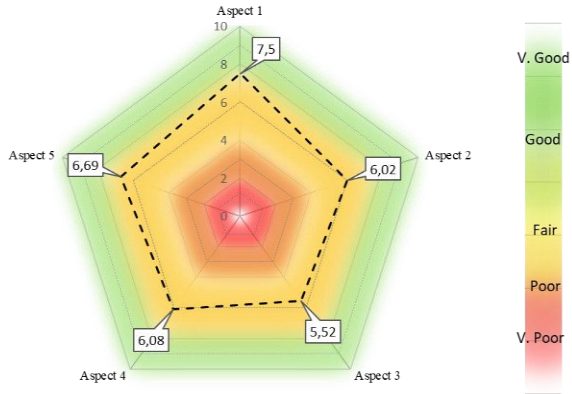

Fig. 5. Road 1 FSRI Assessment Result

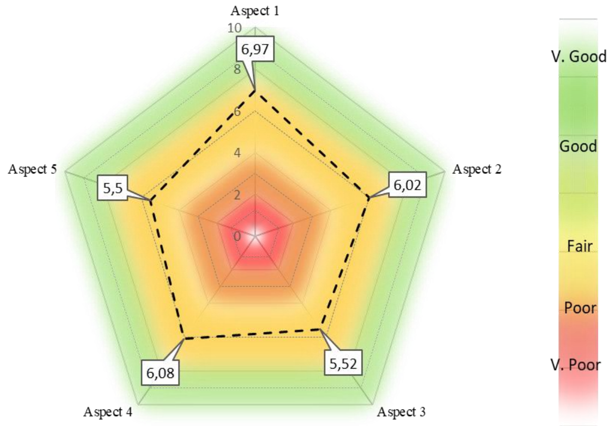

Fig. 6. Road 2 FSRI Assessment Result

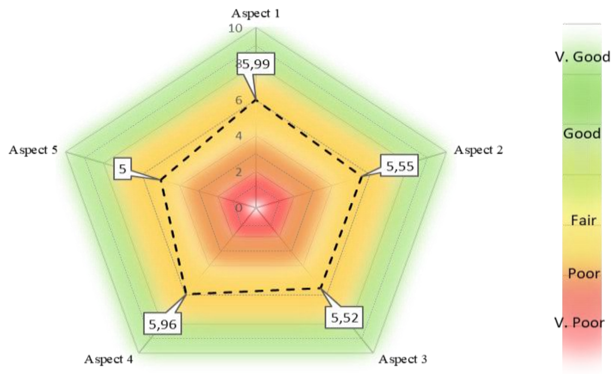

Fig. 7. Road 3 FSRI Assessment Result

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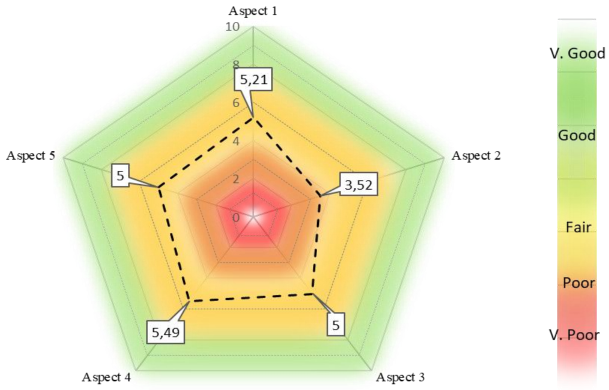

Fig. 8. Road 4 FSRI Assessment Result

B. Road Assessment Using AHP

Assessment using AHP shows each result of assessment of consistency ratio (CR) ≤ 0.1 which means that the experts' assessments on roads are considered consistent. The final assessment on AHP is taken based on the value of the eigenvector obtained. The next step is calculation using AHP:

1) Eigenvector indicator values were obtained from the calculation of the total value of the number divided by the order of each pairwise comparison matrix. The results of the eigenvector values for the Aspect 1 indicator are shown in Table 15.

TABLE 15. EIGENVECTOR VALUE OF INDICATORS ON ASPECT 1

Indicator	L1	L2	L3	L4	L5	Total	*Eigen Vector*
L1	0.400	0.375	0.375	0.429	0.353	1.932	0.386
L2	0.133	0.125	0.188	0.143	0.059	0.648	0.130
L3	0.200	0.125	0.188	0.143	0.353	1.008	0.202
L4	0.133	0.125	0.188	0.143	0.118	0.706	0.141
L5	0.133	0.250	0.063	0.143	0.118	0.706	0.141

CI = 0.067
RI = 1.12 (with n = 5)

$$CR = \frac{CI}{RI}$$

$$= \frac{0{,}067}{1{,}12}$$

= 0.060 ≤ 0.1

The CR value is less than 0.1, then the assessment can be accepted. The eigenvector value is also a weight value for each indicator. The eigen value of each indicator on each aspect can be seen on Table 16.

TABLE 16. EIGENVECTOR VALUE OF EACH INDICATOR ON EACH ASPECT

Indicator	Eigen vector value				
	Aspect 1	**Aspect 2**	**Aspect 3**	**Aspect 4**	**Aspect 5**
1	0.386	0.346	0.401	0.206	0.248
2	0.130	0.183	0.142	0.286	0.240
3	0.202	0.192	0.180	0.166	0.238
4	0.141	0.060	0.060	0.060	0.060
5	0.141	0.191	0.188	0.178	0.173
CI	0.067	0.078	0.030	0.060	0.103
CR	0.060	0.07	0.027	0.054	0.092

2) The eigenvector value for road assessment, in this process generally is done based on data/information about choice assessment (quantitative approach). So that the results of the direct assessment can be normalized for each assessment on each indicator. From the road assessment on each indicator for each aspect, an average road assessment was taken which is also used in calculations using the fuzzy method. The final assessment result were conducted by adding up the multiplication result of the eigenvector value with each indicator usin the matrix multiplication, where the final assessment results are shown in Table 17.

TABLE 17. FINAL ASSESSMENT RESULT OF EACH ROAD ON EACH ASPECT

Road	Final assessment result				
	Aspect 1	Aspect 2	Aspect 3	Aspect 4	Aspect 5
1	0.263	0.257	0.250	0.234	0.274
2	0.255	0.258	0.240	0.228	0.243
3	0.243	0.246	0.245	0.222	0.231
4	0.239	0.211	0.235	0.212	0.211

Based on Table 17, the final assessment results state the weight of the ranking. Thus the greater the final score indicates that the road has a better rating and ranking than the others.

C. Comparison of assessment results

To see the comparison of the assessment result using the FWA and AHP methods, the results of the sustainable road assessment in each aspect of the four road sections are shown in Table 18 and Fig. 9 – 12.

The result of the comparison shows that the assessment which uses the FWA and AHP methods had a comparable result. However, in the AHP assessment, the assessment results only provide ranking numbers. Whereas by using the FWA method, in addition to rating numbers, assessment results are also interpreted with linguistic rating so that the assessment results are easier to understand.

TABLE 18. FINAL ASSESSMENT RESULT OF EACH ROAD ON EACH ASPECT

Road	Sustainable Road Assessment									
	Aspect 1		Aspect 2		Aspect 3		Aspect 4		Aspect 5	
	FWA	AHP	FWA	AHP	FWA	AHP	FWA	AHP	FWA	AHP
1	7,50 (B)	0,263	6,02 (C)	0,257	5,52 (C)	0,250	6,08 (C)	0,234	6,69 (C)	0,274
2	6,97 (B)	0,255	6,02 (C)	0,258	5,52 (C)	0,240	6,08 (C)	0,228	5,5 (C)	0,243
3	5,99 (C)	0,243	5,55 (C)	0,246	5,52 (C)	0,245	5,96 (C)	0,222	5 (C)	0,231
4	5,21 (C)	0,239	3,52 (D)	0,211	5,00 (C)	0,235	5,49 (C)	0,212	5 (C)	0,211

A: very good; B: good; C: fair; D: poor; E: very poor.

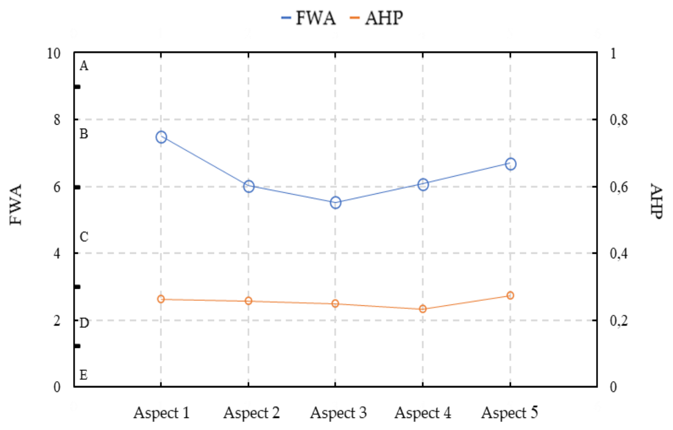

Fig. 9. Comparation of FWA and AHP Assessment Results on Road 1

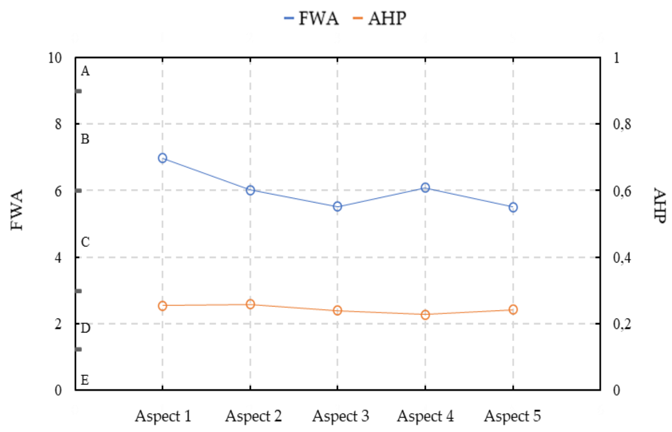

Fig. 10. Comparation of FWA and AHP Assessment Results on Road 2

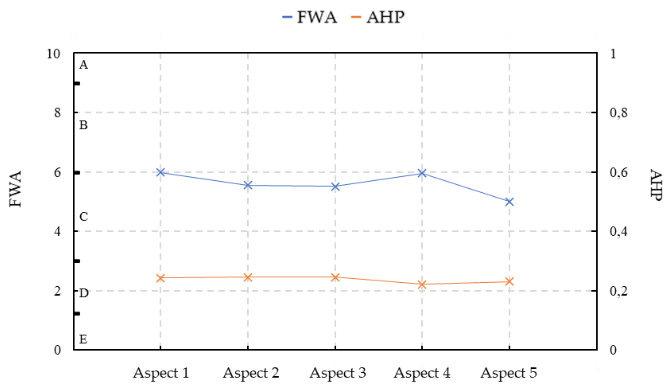

Fig. 11. Comparation of FWA and AHP Assessment Results on Road 3

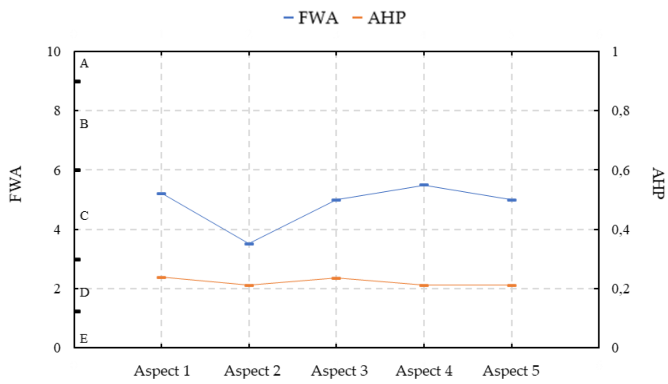

Fig. 12. Comparation of FWA and AHP Assessment Results on Road 4

IV. CONCLUSION

In this study, a sustainable road assessment using fuzzy theory has been developed. Based on the analysis that has been done in developing a sustainable road assessment with fuzzy theory, the conclusions of this study are as follows:

1) The assessment result of the sustainable road for each indicator using the Fuzzy Weighted Average operation was supported by FSRI program on four roads in the South Sumatra region are stated with a 'good' linguistic rating term and 'fair' dominated.
2) The comparison of sustainable road assessment was conducted in the South Sumatra region with the FWA and AHP methods is as follows;

a) In FWA, the assessment is expressed with a numerical value and also interpreted with a linguistic rating term, so that the assessment results are easier to understand. Meanwhile, the AHP only shows the numerical value which means ranking.
b) The results of the FWA and AHP assessment are in line, where the greater the index value of the FWA results, the better the level of sustainability of a road. Likewise with AHP, the greater the weight generated, the higher the rank of the rating.

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