

A Review of Public Compliance with the Function of Markings and Traffic Signs in Bengkalis City

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Abstract. Transportation is a need for every individual, which makes people familiar with the terms traffic signs and road markings. Bengkalis City has numerous locations for traffic signs and road markings, however there are still issues with the general public's poor degree of attention to them. Analysis was performed using statistics software (SPSS), and a Decision Tree was used to classify. From the results of the analysis, it was determined that 61.11% of the signs were in good condition and 38.89% were damaged. According to the markings' state, 27.16 percent of them were in good shape, while 72.84 percent were in damaged condition. In accordance with the findings of the investigation on community behavior in the field, the conditions were different from those reported by the distribution of questionnaires, with 55.91% of respondents obeying to signs and markings.

Keywords: Decision Tree, SPSS, Markings, Traffic Signs

1 Introduction

In their daily routine, humans are never separated from transportation. Every person requires access to transportation. So, the term "traffic signs" is not unfamiliar to us. Traffic signs, which can be in the form of numbers, symbols, letters, words, or a combination of such things, are a critical part of the road infrastructure. They serve to convey messages or different types of information to other road users, such as prohibition messages or warnings for danger or dangerous conditions on the road ahead.

Every day, violations of traffic signs are increasing. Based on the results of the Lancang Kuning operation in 2021, there were 4,495 ticket violations. Increase by (+3,735%) compared to 2020, totaling 780 files. Likewise, enforcement with warnings has increased by 9,487 (+648%) from 1,465 files in 2021. The Riau Regional Police have set targets in the form of seven priority violation points as follows: using a cell phone while driving, underage drivers, having more than one passenger, not using a Standar helmet and safety belt, driving over the speed limit, driving under the influence of alcohol, and finally going against the flow. Low public compliance with traffic rules can increase the risk of accidents and disrupt the smooth transportation of Bengkalis City. This will certainly become a problem in the future, so the cause of this low compliance

level must be identified. Therefore, study is required to determine the extent to which traffic signs and markings in Bengkalis City are followed by the general public.

2 Research Methods

2.1 Traffic signs

Traffic signs are one of the types of road equipment that is in a prescribed form and contains symbols, characters, numbers, words, or a combination of them, according to Regulation of the Minister of Transportation No. 13 of 2014 Governing Traffic Signs on Roads [1]. They are employed to issue instructions, commands, restrictions, and cautions to other drivers. The purpose of traffic signs is to promote efficiency, discipline, and safety when driving. The purpose of road markings and signage is to provide drivers with information, instructions, or directions. Based on type and function, traffic signs can be divided into four categories, namely:

1. Warning Signs.

To alert drivers to potential risks or hazardous locations on the road ahead, warning signs are utilized. Given the traffic, weather, and road conditions brought on by geographic, geometric, and surface-related factors, warning signs are positioned at least 50 meters apart or at a specific distance before the hazard. Warning signs are square or rectangular in design. Yellow is the primary hue of warning signs, with black symbols or writing.

2. Signs of Prohibition.

Actions that are prohibited for road users to perform are denoted by prohibition signs. As closely as possible to where the restriction began are posted prohibition signs. Other guiding signs can be positioned at the proper distance before the ban point begins to provide drivers some first information. Additional boards may be attached to prohibition signs. Prohibition signs may be shaped like an equilateral octagon, an equilateral triangle with rounded corners, a cross with pointed ends, a circle, or a rectangle. Prohibition signs generally have a white background with black or red symbols or wording.

3. Command Signs.

Orders that must be followed by drivers are stated on command signs. Placing command indications as close to the beginning of the duty as possible is required. Guide signs can be positioned at the proper distance from the starting point of the obligation to give drivers preliminary guidance. Additional boards may be added to command signs. The command sign's primary color is blue, while the end of the order's oblique lines are red with a white symbol or lettering.

4. Direction Signs.

Road users can utilize directional signs to indicate directions related to roads, circumstances, cities, places, arrangements, facilities, and more. Directional signs are positioned to be as effective as possible while taking into account the state of the road and the flow of traffic. If

extra boards can be used to indicate the distance between the signs and the thing they are pointing to, then directional signs can be repeated.

2.2 Road Markings

The term "road marking" refers to a sign that is either on the road layer or above the road layer and comprises apparatus or markers that consist of transverse lines, longitudinal lines, symbols, and oblique lines that serve to limit areas of interest to traffic and to direct traffic movement. Regarding the road markings covered by PM No. 67 of 2018 [2], Traffic regulation, warnings, and user guidance are all functions of road markings. Road markings include directives, cautions, and restrictions.

1. Markings that run parallel to the road axis are known as longitudinal markings.
2. Cross markings are the markings that are perpendicular to the road axis. The function of this marker is to remind vehicle users to stop or reduce driving speed.
3. Vehicles are not permitted to cross the oblique markings that are solid lines.
4. To repeat the meaning of traffic signs or to inform drivers of information not specified in the signs, symbolic markers such as arrows, triangles, or letters are utilized. Specifically, the symbol marking is utilized to denote the location where the bus car will stop and to raise and lower passengers. Additionally, it is employed to convey the division of traffic flows prior to reaching an intersection with an arrow as its symbol.

2.3 Traffic Compliance

Traffic obedience or compliance is a type of obeying the laws in which conduct develops as a result of a number of actions that demonstrate adherence to and orderliness with regard to societal norms. All actions that are evaluated in accordance with statutory laws and policies are considered to be in compliance with the law. the Law of the Republic of Indonesia No. 22 of 2009, which governs traffic regulations.

Road users who abide by the law are said to be practicing traffic compliance, which attempts to prevent conflicts between drivers and lessen the frequency of accidents on the road. In line with the infractions committed, drivers who violate traffic laws will be subject to warnings and fines [3].

Traffic compliance is a type of compliance with traffic laws. These recommendations are meant to promote adherence to the rules by drivers so that they benefit other drivers and reduce incidents like traffic accidents.

After providing the aforementioned justification, the researcher draws the following conclusion: "Traffic compliance is a mentality and conduct that was formed through several procedures related to discipline and compliance with traffic rules, where people that violate the regulations will receive warns or punishments from authorities."

Factors that influence individuals on traffic compliance, namely:

1. Individuals obey due to fear of sanctions given by police officers if they violate traffic rules.
2. Self-awareness of traffic safety among road users this means that individuals are aware that obeying traffic rules is an important thing to do.

3. An attitude of mutual respect between road users to create order in traffic.

Factors that affect traffic compliance consist of:

1. Drivers' understanding of traffic rules.
2. Attitudes and behaviors of drivers related to compliance with traffic rules.
3. There is a ticket program from the police, and its effectiveness.

Factors that cause non-compliance resulting in accidents in traffic consist of human, vehicle, road, and environmental factors. Based on the explanation above, it can be concluded that the factors that influence traffic compliance are the driver's understanding of traffic rules, the attitude and behavior of drivers related to traffic rules, and the existence of a ticket program and its effectiveness.

2.4 Compliance Dimension

There are three individual dimensions that comply with the following rules:

1. Compliance is a form of obedience that expects a reward or avoids punishment for the behavior done.
2. Identification is compliance with the law because there is a good relationship between the authority holder and the individual, which depends on whether the relationship or interaction is good or bad.
3. Internalization is legal compliance caused by rewards and intrinsically the laws or rules that apply in accordance with the values one adheres to.

Compliance has two dimensions, namely:

1. Attitude consists of belief, namely the existence of trust between individuals towards other people, and acceptance is an attitude of accepting other people's demands.
2. Behavior consisting of an act is a person's action to carry out orders or requests from others.

The characteristics of obedient people are divided into three categories, namely:

1. Trust, namely the release of personal judgment
2. Accept, namely acceptance of the demands of others
3. Acting means following what is ordered by those who have authority.

Based on the explanation of the theory above, it can be said that traffic compliance includes compliance with the law, and there are three individual dimensions to complying with the law: compliance, identification, and internalization.

2.5 Data Quality Test

1. Validity Test

The questionnaire's questions, or questions that are deemed valid if they reveal the outcome you're trying to assess, are measured using the validity test. According to Hadiana, the degree of congruence between the data actually observed on the object and the data gathered by the researcher is the definition of validity [4]. The column seen in the Statistical item-total table as a consequence of data processing with the Statistical Program For Social Science (SPSS) is the corrected item-Total Correlation column, which can be used to determine an item's validity. These are the criteria used to judge the validity test:

a. If $r_{\text{count}} > r_{\text{table}}$, then the questionnaire items are valid. (1)

b. If $r_{\text{count}} > r_{\text{table}}$, then the questionnaire item is said to be invalid. (2)

2. Reliability Test

A reliability test measures the degree to which measurement results using the same object will result in the same data, or the degree to which the findings of a measurement may be believed. A tool for determining a survey's reliability is that it serves as an indicator of a variable or construct. If one consistently or steadily responds to questions on a questionnaire, it is considered dependable. A test's level of stability, consistency, predictability, and precision is referred to as its reliability. Measurements with high dependability are those that can generate trustworthy data [4].

When doing internal consistency reliability testing, an instrument is used just once, and the results are then examined using certain methods. The analysis's findings can be utilized to forecast the instrument's dependability. The Cronbach Alpha method can be used for reliability testing. This is the equation.:

$$R_i = (k/(k-1))(1 - (\sum \sigma_b^2) / (\sigma^2)) \quad (3)$$

With:

R_i = Reliability of all instruments
 k = Number of items in the instrument
 $\sum \sigma_b^2$ = Total variance of the items
 σ^2 = Total variance

Internal consistency and the Cronbach Alpha formula were utilized for reliability assessment in this study with the aid of the SPSS software. A figure known as the value of the reliability coefficient empirically denotes high or low reliability. A rating close to 1 denotes high reliability.

If the number of items increases, the Cronbach Alpha value will also increase. If the average value of the correlation between items is high, the Cronbach Alpha will increase, and vice versa, the Cronbach Alpha value will be low. The instrument is said to have good reliability or trust if it meets the following criteria:

Cronbach Alpha > 0.9 , so the reliability is very high.
 $0.7 < \text{Cronbach Alpha} < 0.9$, then the reliability is high.
 $0.5 < \text{Cronbach Alpha} < 0.7$, so the reliability is enough.
Cronbach Alpha < 0.5 , so the reliability is very low. (4)

a. Decision Tree

Various groups of people have studied decision trees to aid with decision-making processes in various spheres of life. A decision tree is a categorization and prediction method. Later, using the decision tree method, the facts as they are will be transformed into a decision tree that represents the rules. A decision tree is a classification approach that creates a classification tree from a dependent variable of category type. where the root node is the highest node and the branch carries the attribute's value [5].

A decision tree is a flowchart with a tree-like structure where each internal node (node) symbolizes an attribute, its branches denote test results or attribute values, and its leaves denote classes or class distributions. Data classification strategies include using a decision tree.

The decision tree model is a tree consisting of root nodes, internal nodes, and terminal nodes. While root nodes and internal nodes are variables or features, terminal nodes are class labels. In carrying out classification, a data query will trace the root node and internal nodes until it reaches the terminal node [6]. Query data class labeling based on the label on the internal node. In the Decision tree, there are three types of nodes, namely:

1. The root node is the uppermost node; it has no input, no output, or several outputs.
2. There is only one input and a minimum of two outputs at the internal node, which is a branching node.
3. The final node is called a leaf node, or terminal node; there is only one input and no output at this node.

3. Result and Discussion

3.1 Condition of Markings and traffic signs Installed on Several Roads in Bengkalis City

After making direct observations in the field, several signs were obtained for each road segment. Based on the Regulation of the Minister of Transportation Number 13 of 2014, signs that are included in the good category are signs whose physical condition allows them to function properly, such as the color of the signs not fading, the sign leaves not being broken, the signposts not being broken or bent, and the signs not being obstructed by other objects [1]. The following is a recapitulation of the physical condition of signs on Jalan Gatot Subroto, Jalan Cokro Aminoto, Jalan Sudirman, Jalan Ahmad Yani, and Jalan Antara, according to the table 1:

Table 1 Recapitulation of physical condition signs

No	Road	Condition		Total	Percentage (%)	
		Good	Damaged		Good	Damaged
1	Jalan Gatot Subroto (JGS)	11	9	20	55	45
2	Jalan Cokro Aminoto (JCA)	9	5	14	64.29	35.71
3	Jalan Sudirman (JS)	5	4	9	55.56	44.44
4	Jalan Ahmad Yani (JAY)	5	3	8	62.50	37.5
5	Jalan Antara (JA)	3	0	3	100	0
Total		33	21	54	61.11	38.89

Table 1 shows that for Jalan Gatot Subroto, Jalan Cokro Aminoto, Jalan Sudirman, Jalan Ahmad Yani, and Jalan Antara, out of a total of 54 signs, there are 33 signs in good condition and 21 signs with damaged conditions.



Fig. 1. Good-condition signs and damaged-condition signs

In total, for all roads, 61.11% of signs were obtained in good condition according to Minister of Transportation Regulation No. 13 of 2014, where the condition of the physical signs can function properly, such as the signs' color not fading, their leaves not broken, the signposts not bent or broken, and the signs not blocked by other objects, and 38.89% in damaged condition, where the conditions of the physical signs are not functioning properly, such as the signs' color not fading, their leaves not broken, the signposts not bent or broken, and the signs not blocked by other objects

On the road that the researchers surveyed, there are two intersections of four and two intersections where, of the four intersections, there are three APILLs that are in good condition and one APILL that is damaged and no longer used. APILL conditions that are damaged and no longer used are found on Jalan Antara and Jalan Ahmad Yani, with the condition that the APILL lights are no longer on.

Based on the Regulation of the Minister of Transportation Number 67 of 2018, markings that are included in the good category are markers whose physical condition can function properly, such as marking colors that have not faded, markings that are not covered by soil, and marking colors that have not disappeared [2]. The following is the percentage of the total physical condition of the markings on Jalan Gatot Subroto, Jalan Cokro Aminoto, Jalan Sudirman, Jalan Ahmad Yani, and Jalan Antara, according to the table 2.

Table 2 Percentage of each road's whole quality of markings

No	Marking Type	Percentage (%)	
		Good	Damage
1	Road divider (RD)	55.30%	44.70%
2	Right road line marking (RR)	51.07%	48.93%
3	Left road line marking (LR)	45.30%	54.70%
4	Zebra cross (ZC)	38.46%	61.54%
5	School safety zone markings (SS)	0%	100%
6	Directional sign to turn right (DS)	0%	100%
7	Straight guide markings (SG)	0%	100%

No	Marking Type	Percentage (%)	
		Good	Damage
Total		27.16%	72.84%

From the table 2, the results show that for Jalan Gatot Subroto, Jalan Cokro Aminoto, Jalan Sudirman, Jalan Ahmad Yani, and Jalan Antara, the total for all roads is 27.16% of road markings in good condition in accordance with Minister of Transportation Regulation number 67 of 2018.



Fig. 2. Good condition markings and bad condition markings

Where the physical condition of the markings can function properly, such as when the color of the markings does not fade, the road markings are not covered by soil, and the color of the road markings does not disappear. In field conditions, the markers with damaged conditions were 72.84%, where the physical condition of the marking colors had faded and the marking colors had disappeared so that the markings did not function as they should.

3.2 Determination of Sample Size

The Slovin formula was used to calculate the sample size for this study since it can estimate how many people should be included in the analysis. where N is the sample population of 123,583 people drawn from the Bantan and Bengkalis subdistrict residents, with a 10% error rate. The optimum sample size is as follows:

$$\begin{aligned}
 n &= \frac{N}{N \cdot e^2 + 1} \\
 n &= \frac{123.583}{123.583(0,1)^2 + 1} \\
 n &= \frac{123.583}{1235,83 + 1} \\
 n &= \frac{123.583}{1236,83} \\
 n &= 99,919 \approx 100
 \end{aligned}
 \tag{5}$$

The determination of the sample in this study using the Slovin formula is able to measure the sample size to be studied. Where N is the sample population of the residents of the Bengkalis

sub-district and Banten sub-district, namely 123,583 residents, with an error rate of 10%. The following is the desired sample size.

3.3 Validity Test

A questionnaire's validity is evaluated using a validity test. The SPSS application is used for validity testing. The validity test reveals how accurate a measurement equipment is. The validity test's calculation is based on a 0.195 difference between r_{count} and r_{table} . The statement is accepted as table 3 if r_{count} exceeds r_{table} .

The following are the findings of the validity test for the 13 variables measuring public compliance with the purposes of markings and traffic signs.

Table 3 Compliance Variable Validity Test Results

Item	r_{count}	r_{table}	Information
Pronouncement 1	0,634	0,195	Clear
Pronouncement 2	0,687	0,195	Clear
Pronouncement 3	0,662	0,195	Clear
Pronouncement 4	0,612	0,195	Clear
Pronouncement 5	0,580	0,195	Clear
Pronouncement 6	0,594	0,195	Clear
Pronouncement 7	0,645	0,195	Clear
Pronouncement 8	0,431	0,195	Clear
Pronouncement 9	0,585	0,195	Clear
Pronouncement 10	0,587	0,195	Clear
Pronouncement 11	0,635	0,195	Clear
Pronouncement 12	0,607	0,195	Clear
Pronouncement 13	1,000	0,195	Clear

Based on table 3, the results of the validity test show that all $r_{count} > r_{table}$ (0.195) per item of compliance variable means that all compliance variable items are declared valid.

3.4 Reliability Test Results

A test for reliability assesses how consistently and steadily an instrument's results are produced. The most commonly used reliability test is the Cronbach's Alpha coefficient. A measurement device is said to be dependable in a reliability test if the measurement is accurate and consistent. In order to ensure the accuracy of data measurements, the instrument reliability test is conducted to determine the consistency of the instrument as a measuring tool.

The following are the results of the reliability test for the understanding variable and the compliance variable in the public compliance questionnaire on the functions of markings and traffic signs.

Table 4. Compliance variable reliability test results

Reliability Statistics	
Cronbach's Alpha	N of Items
.817	13

Based on the results of the reliability test as table 4, it can be seen that for the compliance variable, the Cronbach's Alpha value is $0.817 > 0.60$, meaning that the variable is declared reliable.

3.5 Level of Compliance of Road Users on Several Roads in Bengkalis City with Signs and Markings

As for knowing the level of compliance of the road user community with the function of traffic signs in terms of the distribution of questionnaires and the behavior of the community in the field,

1. Reviewed Through the distribution of questionnaires

The level of compliance of the road user community with signs and markings was obtained from filling out a questionnaire by 100 respondents, which was then analyzed using Microsoft Excel so that the respondents' answers related to the level of compliance of road users with the function of signs and markings were obtained as table 5.

Based on table 5, the values obtained from 100 respondents were 0 respondents who obeyed the functions of markings and traffic signs with a percentage of 0%, as many as 16 respondents who were quite obedient to the functions of markings and traffic signs with a percentage of 16%, and as many as 84 respondents who lacked compliance with the functions of markings and traffic signs with a percentage of 84%.

Table 5. value of road user communities' compliance with markings and signs

No	Information	N
1	obeyed (Ob)	0
2	quite obedient (Qo)	16
3	lacked compliance (Lc)	84
Total		100

So it can be concluded that of the 100 respondents who were dominant, 84 respondents (84%) were less obedient to the function of signs and markings, namely 84 respondents (84%) from 13 questionnaire questions related to compliance with signs and markings with variable indicator questions regarding traffic discipline on the highway, such as obeying the rules and

prohibitions on traffic signs and road markings, obeying traffic signaling devices, speed limit rules, carrying a driving license and Vehicle Registration Certificate, and wearing an helmet for motorcyclists.

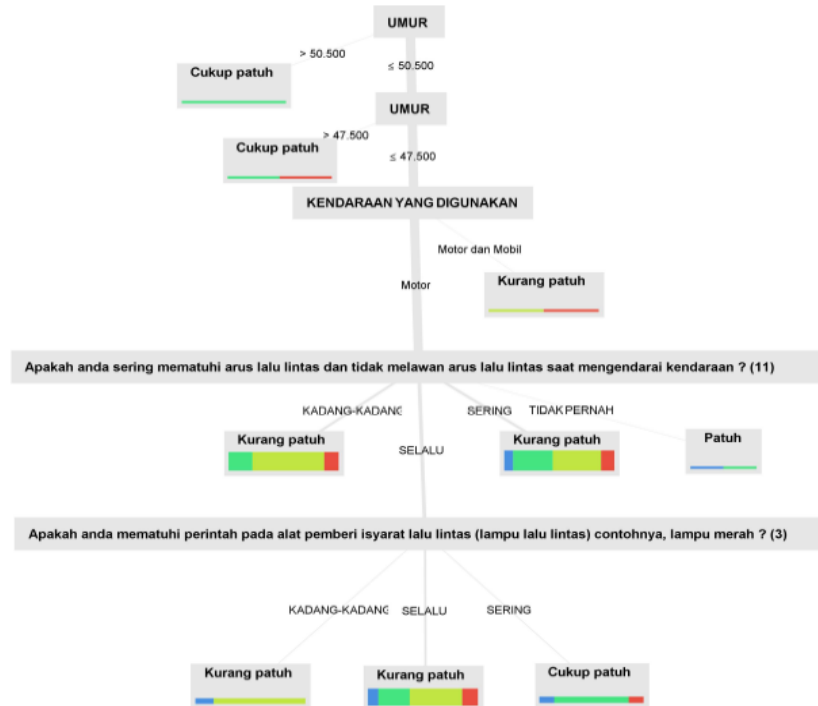


Fig. 3. Analysis of public compliance with the functions of markings and traffic signs using a decision tree.

After doing the analysis using Microsoft Excel then proceed with the classification using a decision tree. In the decision tree modeling in Figure 3, there are 9 leaf nodes resulting from the Decision Tree classification, with a total of 5 leaf nodes (less compliant), 3 leaf nodes (quite compliant), and 1 leaf node (compliant). So the most leaf nodes are leaf nodes that are less compliant.

The accuracy value is the proportion to the number of correct predictions [7]. The following is the accuracy formula:

$$\text{Accuracy} = \frac{TP+TN}{TP+TN+FN+FP} \quad (6)$$

Information:

TP : True Positive; the amount of data is correct and predicted correctly.

TN : True Negative; the amount of data is wrong and the prediction is wrong.

FP : False positive; the amount of data is wrong but the prediction is correct.

FN : False negative; the amount of data is correct but the prediction is wrong.

Based on Figure 4, the accuracy value obtained from the classification process using a decision tree is 50.00%.

$$\begin{aligned} \text{Accuracy} &= (TP+TN)/(TP+TN+FN+FP) \\ &= (0+5)/(1+3+5+1) \end{aligned} \quad (7)$$

$$= 5/10$$

$$= 0,5 \text{ or } 50.00\%.$$

accuracy: 50.00%

	true Patuh	true Cukup patuh	true Kurang patuh	true Tidak patuh	class precision
pred. Patuh	0	0	0	0	0.00%
pred. Cukup patuh	0	0	0	0	0.00%
pred. Kurang patuh	1	3	5	1	50.00%
pred. Tidak patuh	0	0	0	0	0.00%
class recall	0.00%	0.00%	100.00%	0.00%	

Fig. 4. Decision tree prediction results for compliance level

1. In terms of behavior in the field

The level of public compliance with the functions of markings and traffic signs was not only obtained from the distribution of questionnaires, the researchers also examined it from the perspective of community behavior in the field. The locations surveyed for traffic sign violations were the Ahmad Yani intersection, the Gatot Subroto intersection, and the Bengkel River intersection. The following is the percentage level of compliance with the functions of markings and traffic signs in terms of people's behavior.

Table 6. Percentage of community compliance level viewed from field behavior

No	Location	Percentage (%)	
		Comply	Disobey
1	Ahmad Yani Intersection (AYI)	64.87	35.13
2	Gatot Subroto Intersection (GSI)	75.98	24.02
3	Bengkel River Intersection (BRI)	26.89	73.11
	Total	55.91	44.09

Based on Table 6, the total violation rate is 44.09% and the compliance rate is 55.91%. So from the results of the questionnaire and the behavior of the people in the field, different results were obtained, namely that if viewed from the results of the respondents' answers, they were less obedient, but the behavior in the field was quite obedient.

From the results of the combination of data processing using Microsoft Excel and classification using a decision tree on the level of public compliance, it can be concluded that the values are almost the same. Where the results of data processing using Microsoft Excel were 84% less compliant and the results from classification using a decision tree obtained 55% less compliant categories.

4. Conclusion

From this research, it can be concluded that:

1. From the research results, it was found that out of a total of 54 signs on Jalan Gatot Subroto, Jalan Cokro Aminoto, Jalan Sudirman, Jalan Ahmad Yani, and Jalan Antara, 33 were in good condition and 21 had damaged conditions. The condition of the markings show that the total for all roads is 27.16% with good condition markings and 72.84% having broken conditions, whilst the total for all roads is 61.11% with good condition signs and 38.89% with broken conditions.
2. From the results of the study by distributing questionnaires related to the level of community compliance, 84% were less compliant, but from the survey results of community behavior in the field, different conditions were obtained where adherence to sign violations was 55.91% compliant.

Acknowledgements

The author would like to thank the parties involved in providing information, especially the people around Bengkalis Island who have paid attention to the questionnaire that has been filled out. This is an important condition related to the condition of the field as a whole.

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