

WebGIS Mapping The Distribution Of Batam Island Bus Stop

Oktavianto Gustin¹, Yulia²

{oktavianto@polibatam.ac.id¹, yuliaa807@gmail.com²}

Geomatics Engineering, Politeknik Negeri Batam¹²

Abstract. People in the city of Batam as well as local and foreign tourists who want to travel, especially in the city of Batam, find it difficult to know the location, position, and location of the bus stop. Although so far there are google maps that provide information on the availability of road facilities, for some places, google maps has not provided information about bus stops. Another way is needed to provide information on the location of bus stops in the city of Batam, not only through information obtained from city bus officers. People do not know about the existence of the bus stops on Batam Island, because of the lack of spatial information about the location of the bus stops on Batam Island. Media is needed to provide information and the location of the bus stops on Batam Island. The initial step taken by the researcher was collecting data in the form of data information such as the coordinates of the bus stop. Then carry out a site survey by taking coordinates or points from the location of each Batam Island bus stop, and proceed with data processing until the goal of this research is achieved in the form of WebGIS distribution of Batam Island shelters.

Keywords: WebGIS, Bus Stop, Batam Island.

1 Introduction

GIS is a computer-based system that can handle geographically referenced data, namely data entry, and data management [1]. While the Web uses several languages of programming that are closely related to the process of scripting going on in it. In general, there are two scripting processes on the web, namely: [2].

A. Client-side scripting; is a scripting process that allows users to interact with the web. Typical client-side scripting activation is to use the navigation facility found on the web. Client-side scripting languages used in this study are HTML, CSS, and JavaScript.

B. Server-side scripting; is a scripting process that works by sending information on servers. Then, the server runs that programming process that information and sends it return the result. A server-side scripting language used in this research is PHP.

Besides that Web GIS can be interpreted as web mapping which means mapping the internet, but not only mapping the internet, and does not mean only displaying maps in the form of static images on an Internet site. If you only show a static map on a site, then there is no difference between web mapping and maps on other media. As a reference to this understanding, it can be seen that Web GIS is based on mapping based on geographic information systems that utilize internet media in mapping. Mapping itself is a grouping a collection of related regions The geographic location of the region includes the highlands, mountains, resources, and population potential influence on the social culture that has special characteristics in the use of appropriate scales [3].

People on the island of Batam who want to travel especially within the city of Batam find it difficult to find the location, position, and location of the bus stop. although so far there are google maps that provide information on the availability of road facilities, for some places, google maps has not provided information about bus stops. The bus stop is one of the facilities for traffic management and transportation support roads, especially for transport users in general [4]. Transportation for batam residents is needed to support the rapid development of the city as in previous research [5] businesses in industry and tourism. Another way is needed to provide information on the location of bus stops in the city of Batam, not only through information obtained from city bus officers.

Based on this description, a solution is needed to create a mapping of the distribution of shelters based on Web GIS that is able to find the location of bus stops in the city of Batam. In addition, this Web GIS is equipped with route information and the coordinates of the Trans Batam bus so that you can find out travel routes and bus stops on the island of Batam easily.

2 Research Data & Methodology

The data used in this study are the Batam Island administration map, coordinates of the main bus stop on Batam Island, TransBatam bus corridor information, Photos of each main stop, TransBatam bus departure schedule information.

This research was conducted on Batam Island, Riau Islands Province, Indonesia. Which is located at 1° 04' 00.25" North Latitude and 104° 01' 54.70" East Longitude can be seen in **Figure 1**.

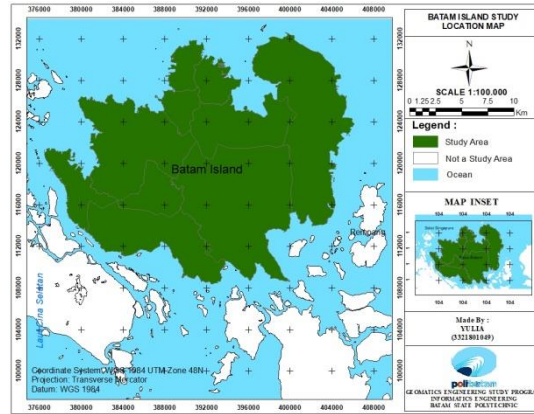


Fig. 1. Research Location.

The software used in the processing of this research is QGIS Desktop 3.10.9, Arcmap 10.5, Visual Studio Code 1.48, PgAdmin 4 (PostgreSQL and PostGIS extensions), XAMPP 3.2.4, Google Chrome, Free domain, and hosting.

2.1 Use Case Diagram

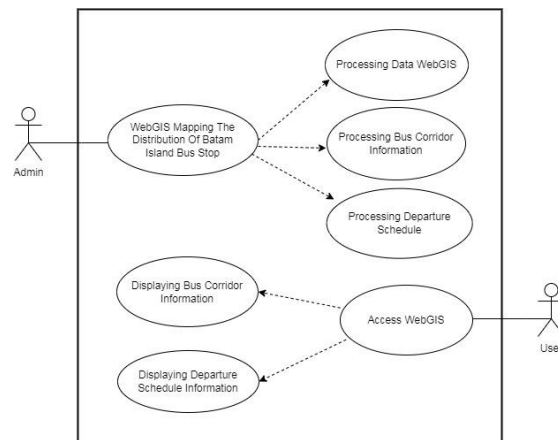


Fig. 2. Use case diagram.

Figure 2 shows two main actors, namely the admin and the user. Admin actors have access to process all WebGIS data, process bus corridor information, and bus departure schedules. And we can see that the actor user can access WebGIS which will display data on bus corridor information and bus departure schedules.

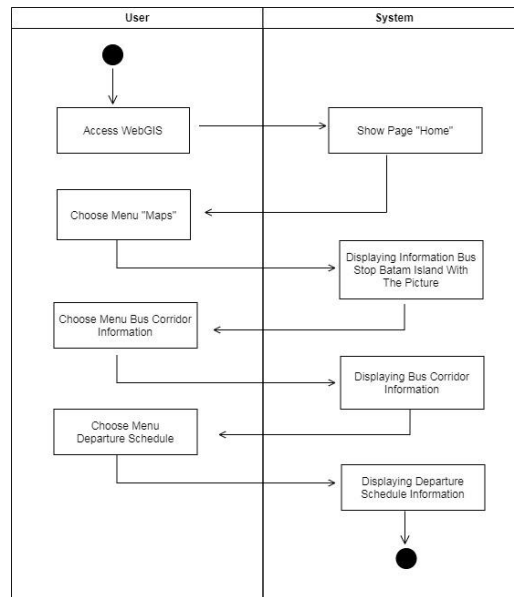


Fig. 3. Activity Diagram.

Activity diagrams show the flow of processes carried out by either the user or the admin. **Figure 3** shows the WebGIS activity diagram. Which, when the user opens the WebGIS mapping the distribution of the bus stop, the system will show the Map page. The system also displays bus departure schedules along with bus corridor information.

2.2 Entity Relationship Diagram

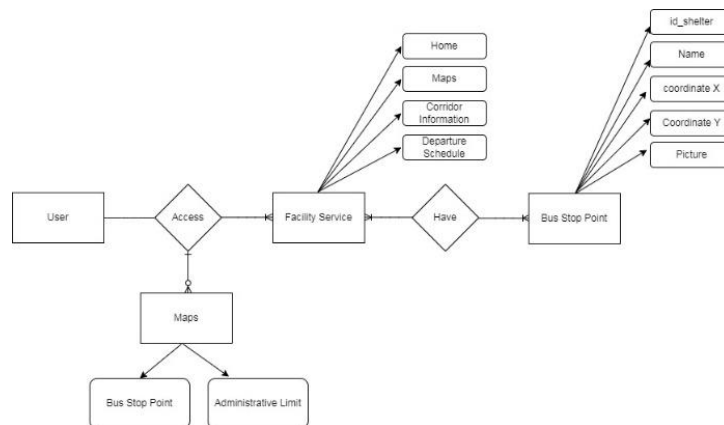


Fig. 4. Entity Relationship Diagram.

Figure 4 shows that the webGIS created has 4 entities, namely users, maps, service facilities, point stops. Map entities have 2 attributes, namely: main stop points, and administrative

boundaries. The facility service entity has 4 attributes, namely home, map, corridor information, and departure schedule. The point stop entity has 5 attributes, namely: id_halte, name, X coordinates, Y coordinates, and photos. These entities have their respective relationships. The user entity has a relationship with the facility and map service, the relationship it has is many to many, meaning that the user can access all data in the facility and map service entity. The relationship between facility services and point-stop entities is many to one, this relationship illustrates that one facility service has many stop points. While the stop point is only owned by one service facility.

2.3 Data Collection Techniques

In this study the method used is as follows:

A. Literature Study

The process of collecting theoretical reference data on the needs in solving problems. The references collected are through existing journals.

B. Survey of the location of the main bus stops on the island of Batam

At this stage, the writer was assisted by the Transportation Department employee to go down to the field to take the coordinates of the bus stop location on Batam Island. Plotting using google maps as many as 19 points location of the main bus stop on Batam Island shown in **Figure 5**.

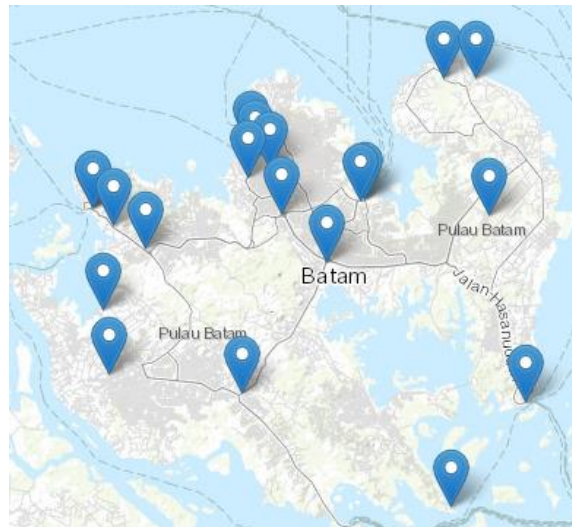


Fig. 5. Bus Stop Point.

2.3 Data Processing Techniques

A. Plotting the coordinates of the main stop, the plotting is done using google maps as many as 19 points, plotting using google maps which are then inputted into excel and entered into QGIS.

- B. Batam island SHP data and bus stop coordinates are processed in QuantumGIS software > then import SHP data into the database in PostgreSQL and run PgAdmin > establish database connection to GeoServer. where the Spatial database describes a set of entities, either having a location or fixed or non-permanent position or (has a tendency to change, move, or develop). These spatial types have basic topographical properties that have a location, dimensions, and shape [6]
- C. Then create a web display design that will be used for WebGIS the main stop on Batam Island > create a folder in XAMPP storage including CSS, JS, images, layers, and leaflets combined in one folder.
- D. WebGIS display design with basic HTML structure using visual studio code > Followed by scripting to form other menus.
- E. If the WebGIS display design is finished, upload it to web hosting > do usability testing with the SUS method on WebGIS to find out whether WebGIS is feasible to use.

3 Results And Discussion

3.1 Interface Implementation

At the implementation stage, the interface is formed based on the appearance of the interface design stage.

3.1.1 Interface Implementation of Home Page

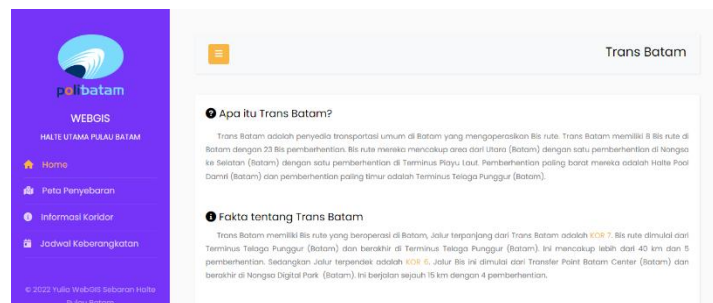


Fig. 6. Home Page.

Figure 6 is the main page/home page on the WebGIS distribution of the main bus stops on Batam Island which contains information about TransBatam buses. When the user enters the <https://webgishalte.000webhostapp.com/> link, the user will be taken to this page.

3.1.2 Interface Implementation of Map Page

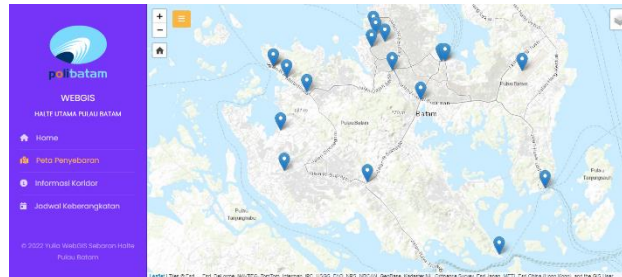


Fig. 7. Map Page.

Figure 7 is a display of the map menu which will display a map of the distribution of the main bus stops on Batam Island with 19 main bus stops on Batam Island. When a point is clicked, a pop-up will appear containing an image and an explanation of the stop point.

3.1.3 Interface Implementation of Corridor Bus Information Page

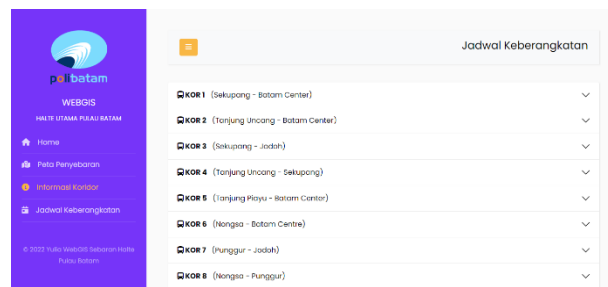


Fig. 8. Corridor Bus Information Page.

Figure 8 is a display of the corridor information menu which will display information on 8 TransBatam bus corridors so that users can find out which stops are passed by each corridor on the TransBatam bus.

3.1.4 Interface Implementation of Departure Schedule Page

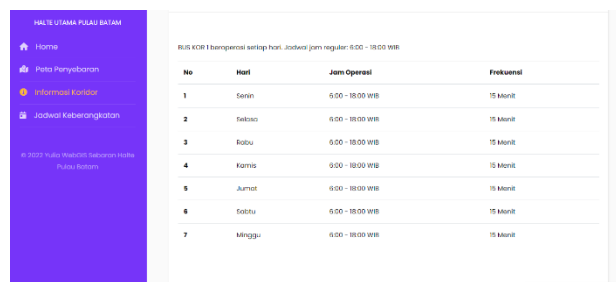


Fig. 9. Departure Shedule Page.

Figure 9 shows the departure schedule menu display which contains an explanation of the bus departure times in each corridor on the TransBatam bus.

3.2 Usability Test

Usability is the ability level that can be done by the website for someone or a user in performing a set of tasks that he needs. Determination of a usability website refers to how efficient use, how long it can be remembered, how many mistakes were made, and how long someone likes to use it. Based on these things, testing usability is carried out by referring to 5 factors namely learnability, efficiency, memorability, errors, and satisfaction [7]. The decent sample size in research is between 30 to 500 [8]. At this stage, a usability test has been carried out using the SUS (System Usability Scale) method to determine the feasibility of the Batam Island Bus Stop Distribution WebGIS. SUS is a standard questionnaire used to measure the satisfaction of users or users in using a system. SUS was also known as “quick and dirty” in Means of measuring user satisfaction the use of the SUS questionnaire is very fast and data reliable results. Filling out the questionnaire SUS was carried out after the respondent used the evaluated system [9]. The list of SUS Questionnaires in **Table 1** is divided into ten different questions, the ratio of positive questions and negative questions is 50%:50%. In this study, five Likert scales were used with information, 1: Strongly Disagree, 2: Disagree, 3: Neutral, 4: Agree, and 5: Strongly Agree as in previous studies [8].

The following is a list of questions that will be asked to respondents, each of which aims to determine whether this WebGIS is suitable for use or needs to be improved.

Table 1. Questionnaire SUS.

Number	Questionnaire
1.	I feel that I will often use this WebGIS of Batam Island Main Stop
2.	I feel that the Batam Island Main Stop WebGIS doesn't need to be this complicated
3.	I think this Batam Island Main Stop WebGIS is easy to use
4.	I think I need help from other people when using this WebGIS of Batam Island Main Stop
5.	I see that the various functions in the Batam Island Main Stop WebGIS are well implemented
6.	I think there are many discrepancies in this WebGIS of Batam Island Main Stop
7.	I feel that it will be easy for many people to quickly learn this WebGIS of Batam Island Main Stop
8.	I see that the Batam Island Main Stop WebGIS is very complicated to use
9.	I feel confident when using WebGIS Batam Island Main Stop
10.	I need to learn a lot before I can use this WebGIS of Batam Island Main Stop.

The scale of the respondent's answers is reduced by 1 for each answer with an odd number. For answers with even numbers, 5 will be reduced by the scale of answers from respondents. The SUS score is obtained from the sum of the scores for each question which is then multiplied by 2.5. The average SUS score is the division of the number of SUS scores by the number of respondents. The SUS value was obtained from the average value obtained from the respondents. Calculate the average value using see equation (1).

$$\bar{x} = \frac{\sum x}{n} \quad (1)$$

\bar{x} = Average SUS

$\sum x$ = Total SUS Score

n = Total Respondent

The results of the SUS score will then be adjusted to the SUS assessment, as we can see in **Figure 10** Entering the category where the test results are based on the average score that has been obtained.

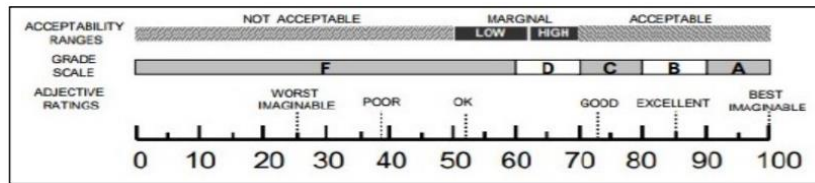


Fig. 10. Determination of SUS Assessment Results.

The SUS questionnaire was given to people who use the TransBatam bus. The number of samples used in this study was 30 people. Determination of the number of respondents refers to research conducted by Sugiyono which states that the appropriate sample size in the study is between 30 to 500. The results of the questionnaire obtained from 30 respondents can be seen in Table 2 Questions with odd numbers are positive questions and questions with even numbers is a negative question.

Table 2. Questionnaire SUS.

Respondent	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10
R1	3	3	4	4	4	2	4	2	3	4
R2	4	4	5	4	5	2	5	2	4	4
R3	4	1	5	2	5	1	4	1	5	1
R4	3	2	5	2	4	2	5	2	4	3
R5	3	3	4	2	4	2	4	2	3	3
R6	4	2	5	1	4	3	5	2	4	3
R7	4	2	5	2	4	2	4	2	4	2
R8	2	2	4	3	2	2	4	3	3	5
R9	5	5	5	1	5	1	5	1	5	3
R10	4	1	5	2	5	2	5	2	5	5
R11	4	4	4	4	4	2	4	2	4	4
R12	2	2	5	5	5	3	4	4	3	5
R13	3	2	4	2	4	2	4	2	4	2
R14	4	2	5	2	4	2	4	2	4	2
R15	4	3	5	4	5	2	4	2	4	3
R16	4	4	4	4	4	4	4	4	4	4
R17	3	4	4	2	4	4	4	2	3	4
R18	4	3	3	3	4	2	3	3	4	4

R19	2	4	2	4	3	4	3	3	3	5
R20	4	3	4	2	4	2	4	2	4	2
R21	3	2	3	3	3	3	3	3	3	3
R22	5	3	5	2	4	2	5	2	5	4
R23	5	3	5	2	5	1	5	2	5	3
R24	4	2	5	2	4	2	5	1	4	2
R25	5	4	5	3	5	2	4	2	4	3
R26	5	2	5	1	4	2	5	2	5	1
R27	4	3	5	3	5	3	5	1	4	3
R28	5	3	4	2	4	2	4	2	4	2
R29	4	2	4	1	4	2	4	2	4	2
R30	4	4	4	5	4	2	4	2	4	5

The results of the questionnaire in Table 2 have not been calculated. Furthermore, calculations are carried out using the SUS method. For each question with an odd number, the respondent's answer scale is reduced by 1. Each question with an even number will be on a Likert scale, which is 5 minus the scale of the respondent's answer. We can see the calculation results from SUS's answer in Table 3.

Table 3. Calculation of the Answer SUS.

Respondent	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q 10	Score SUS
R1	2	2	3	1	3	3	3	3	2	1	23
R2	3	1	4	1	4	3	4	3	3	1	27
R3	3	4	4	3	4	5	3	4	4	4	38
R4	2	3	4	3	3	3	4	3	3	2	30
R5	2	2	3	3	3	3	3	3	2	2	26
R6	3	3	4	4	3	2	4	3	3	2	31
R7	3	3	4	3	3	3	3	3	3	3	31
R8	1	3	3	2	1	3	3	2	2	0	20
R9	4	0	4	4	4	4	4	4	4	2	34
R10	3	4	4	3	4	3	4	3	4	0	32
R11	3	1	3	1	3	3	3	3	3	1	24
R12	1	3	4	0	4	2	3	1	2	0	20
R13	2	3	3	3	3	3	3	3	3	3	29
R14	3	3	4	3	3	3	3	3	3	3	31
R15	3	2	4	1	4	3	3	3	3	1	27
R16	1	1	1	1	1	1	1	1	1	1	10
R17	2	1	1	3	1	1	1	3	2	1	16
R18	1	2	2	2	1	3	1	1	1	1	15
R19	1	1	1	1	2	1	2	2	2	4	17
R20	1	2	1	3	1	3	1	3	1	3	19
R21	2	3	2	2	2	2	2	2	2	2	21
R22	4	2	4	3	1	3	4	3	4	1	29
R23	4	2	4	3	4	0	4	3	4	2	30
R24	1	3	4	3	1	3	4	0	1	3	23
R25	4	1	4	2	4	3	1	3	1	2	25

R26	4	3	4	0	1	3	4	3	4	0	26
R27	1	2	4	2	4	2	4	0	1	2	22
R28	4	2	1	3	1	3	1	3	1	3	22
R29	1	3	1	0	1	3	1	3	1	3	17
R30	1	1	1	4	1	3	1	3	1	4	20

After getting the SUS score from each respondent, the SUS score of each respondent will be multiplied by 2.5 then the multiplication results are added up to get the average value as in Table 4.

Table 4. Score Multiplication SUS x 2.5.

Respondent	Score SUS x 2.5	Amount
R1	23 x 2.5	57.5
R2	27 x 2.5	67.5
R3	38 x 2.5	95
R4	30 x 2.5	75
R5	26 x 2.5	65
R6	31 x 2.5	77.5
R7	31 x 2.5	77.5
R8	20 x 2.5	50
R9	34 x 2.5	85
R10	32 x 2.5	80
R11	24 x 2.5	60
R12	20 x 2.5	50
R13	29 x 2.5	72.5
R14	31 x 2.5	77.5
R15	27 x 2.5	67.5
R16	10 x 2.5	25
R17	16 x 2.5	40
R18	15 x 2.5	37.5
R19	17 x 2.5	42.5
R20	19 x 2.5	47.5
R21	21 x 2.5	52.5
R22	29 x 2.5	72.5
R23	30 x 2.5	75
R24	23 x 2.5	57.5
R25	25 x 2.5	62.5
R26	26 x 2.5	65
R27	22 x 2.5	55
R28	22 x 2.5	55
R29	17 x 2.5	42.5
R30	20 x 2.5	50

Average	60.75
----------------	-------

After calculating the SUS score in Table 4 with a score of 60.75 then we will determine the grade of the results of the assessment. In determining the grade of the results of the assessment there are 2 ways that are used. The first determination can be seen from the level of user acceptance, grade scale, and adjective rating which consists of the level of user acceptance there are three categories, namely not acceptable, marginal, and acceptable. Meanwhile, in terms of grade level, there are five scales, namely A, B, C, D, and F. From the adjective rating they are divided into worst imaginable, poor, ok, good, excellent, and best imaginable as shown in Figure 10.

The results of the second determination, we look at the percentile ranking (SUS score) which has an assessment value consisting of A, B, C, D, and F. From the two methods of determination, we can see the results of the assessment are as follows:

A. Accessibility, Rating Scale, Adjective Rating :

Determination of accessibility, grade scale, and adjective rating is used to see how far the user views the WebGIS for the distribution of Batam Island Main Stops. In determining the Accessibility, Value Scale, and Adjective Ranking, we compare the results of the average respondent's assessment of 60.75. Therefore, the results of the assessment of the WebGIS for the distribution of the main bus stops on Batam Island are as follows:

- The level of user acceptance falls into the marginal high category
- The level of the scale value falls into the D . category
- Adjective ratings fall into the Ok category.

B. SUS Score percentile rank:

The determination of the results of the assessment using the SUS score of the percentile rating is carried out by comparing the results of the user assessment in general. Therefore, in determining the SUS score, the following provisions are made:

- A score: that is a score greater than or equal to 80.3
- B score: that is greater than 74 and less than 80.3
- C score: that is a score greater than 68 and less than 74.
- D score: that is a greater score is equal to 51 and a smaller score is 68.
- F score: that is the score is less than 51.

Based on the provisions for determining the results of the SUS score assessment, the results of the respondents' assessment of the WebGIS distribution of the Batam Island Main Bus Stop is 60.75, which is in grade D. This situation is due to differences in perspectives in the process of determining the final results of the assessment. In general, the results of the respondents' assessment of the WebGIS of Batam Island's Main Halte Distribution can be said to have been well received by the respondents and suitable for use.

4 Conclusion

Based on the results obtained from this study, the author has built a WebGIS for the distribution of the main bus stops on Batam Island by processing the data that has been

obtained from the results of field surveys. WebGIS distribution of Batam Island Main Stops has been successfully uploaded to web hosting and usability tests have been carried out using the SUS method. From the test, the WebGIS of the Batam Island Main Bus Stop has an accessibility value with a marginally high category, which means that the respondents have a point of view that this WebGIS has been made properly. Then for the results of the grade scale with category D and adjective rating with category Ok, which means that the WebGIS distribution of the Batam Island Main Bus Stop has been well received by the respondents and is suitable for use.

Reference

- [1] Gustin, O., Arsyika, F., Novitasari, T., Arpani., and Rahmawati, M. A.: Inventory Mapping of Ownership, Authorization, Use, and Utilization of Land-based on Geographic Information System (GIS) on Tanjung Uma Village in 2019. Proceedings of ICAE 2020, ISBN: 978-989-758-520-3 (2020)
- [2] Motive: The Motive Web Design Glossary. Retrieved from Juni 24, 2020: <http://www.motive.co.nz/> (2004)
- [3] Verawati Puce: Pemetaan Sebaran Mangrove Di Pulau Saronde Kabupaten Gorontalo Utara Dengan Menggunakan Citra Satelit Quickbird. Skripsi Universitas Negeri Gorontalo, Gorontalo (2017)
- [4] Dishub: Retrieved from Dinas Perhubungan: <https://dishub.bulelengkab.go.id/informasi/detail/artikel/halte-fungsi-estetika-dan-etika-56> (2019)
- [5] Gustin, O., Manik, R. U., Rassarandi, F. D., Roziqin, A., Isya, N. H., & Krisna, T. C.: Land Surface Temperature Identification Based on Data of Landsat 8 on Batam Island. In 2020 3rd International Conference on Applied Engineering (ICAE), (pp. 1-6), IEEE (2020)
- [6] Saputra: Sistem Informasi Geografis: Konsep-konsep Dasar (Perspektif Geodesi dan Geomatika). Informatika, Bandung (2011)
- [7] Zahara, L., Munthe, I. R., & Ritonga, A., A.: Sistem Informasi Geografis Pemetaan Sekolah Menengah Kejuruan Di Kabupaten Labuhanbatu Menggunakan Webgis. JURTEKSI, Vol. 7, No. 2 (2021)
- [8] Sugiyono: Metode Penelitian Pendidikan Pendekatan Kuantitatif, kualitatif, dan R&D. Alfabeta, Bandung (2014)
- [9] Zulkarnain, S. M., Sudarsono, B., & Nugraha, A. L.: Pemanfaatan Webgis Untuk Pemetaan Persebaran Spbu Di Kota Semarang. Jurnal Geodesi UNDIP, 4(3), pp. 19-25. (2015)