Determination of the bridge maintenance and rehabilitation priority scale in kabupaten Pinrang

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Abstract. This study attempts to get the support system to help stakeholders and the decision makers in the determination of priorities the maintenance and rehabilitation of the Bridge. The location of the study is done in Kabupaten Pinrang. Bridge damage value is specified using assessment standard Bridge Management System (BMS). There are 13 Bridges by details as follows: good condition with the condition 1 in 6 Bridge, damaged with the condition two as many as five fruit Bridges and there are two Bridges by value condition of three which means need handling rehabilitation. From our observation examination Bridges and it has been obtained the results of then afterward determined the priority scale by using the method Analytic Hierarchy Process. The discussion or interview of 27 respondents in completion question to determines the priorities of handling bridges by three (3) criteria and three sub-criteria with weights each: a condition of damage with weights 0,491 or amounting to 49,1 % followed by criteria policy with weights 0,324 % then criteria volume traffic weight of 0,185 or 18.5 %. Based on the results of this can be concluded that the implementation of a method of Analytic Hierarchy Processing is effective in determining the scale of priorities for the stakeholders. Having acquired value bridge condition and weights of the assessment results of the, then is needed to Analysis of spatial use application ArcGIS to obtain information condition Bridge Map.

1. Introduction
Bridge such an important part in a system of the road network, because the effect would who mean that if the bridge collapse or did not function properly, collapse the bridge will reduce or restrain traffic, which means disturb the flow of the transportation of people and goods. For that reason should this infrastructure maintained well so its performance can be increased or defended

Obstacles faced by office works Kabupaten Pinrang that is they did not the implementation of the maintenance Bridges like program routine maintenance and maintenance intervals. Which routine maintenance performed to repair damage bridge on the damage level of light. Depart from this problem hence writers interested to draw up a system the determination of to judge priority maintenance bridge approach in Analitical Hierarchy Process and the device system information that can be showing the combination of technical data bridges and information supporting analysing data with on the Arc Info

Examination and maintenance Bridge is a series of process of Bridge Management System which includes routine maintenance intervals for the purpose to give a monitoring system and control maintenance better [1]. Maintenance done be gave a hope that all the in Indonesia will be effective and the purpose of an examination this Bridge was to convince that bridges are working safely and the need for held a certain action to the maintenance and repair of periodically of maintenance in bridge
any very important to therefore condition bridge is staying on its function, Huang, y.h [2]. Assessment of damages bridge do with some components, of the components next divided into such element .Elements bridge itself formed of elements at the level of smaller as constituent. Each the destruction on element starting from elements smallest given code for uniformity understanding and ease in insert data. Started at the level of 1 structure bridge in A whole, the level of 2 is part of the river, building up and building bottom. While the level of elements 3,4,5 is the smallest of the level of 2. Damage-damage that has been identified then given judgment whereby a judgment this condition is done based on the categories the value of the structure, the level of damage, the quality of damage, their influence on the functions of an element concerned and on other element. From scoring the condition of the bridge it will be in a kind of handling know as on a table in the following.

| Value Of The Condition | Handling               |
|------------------------|------------------------|
| 0-2                    | Routine Maintenance    |
| 3                      | Rehabilitation         |
| 4-5                    | replacement            |

1.1. Analytical Hierarchy Process (AHP)
AHP a model supporting a decree being developed by Thomas L. Saaty. Supporting model decision will disassemble problems multi-factors or multi the criteria a complex being a hierarchy, according to saaty [3], Analytical Hierarchy Process the had the capability to solving problems that multi the criteria based on a comparison preperensi of any element and their hierarchy [4]

| Intensity interests | Description                                      |
|---------------------|--------------------------------------------------|
| 1                   | Second as important element                      |
| 3                   | One element a little more important              |
| 5                   | One element more important                       |
| 7                   | single element obviously very important          |
| 9                   | One element absolute far more important          |
| 2,4,6,8             | values between two values taking into account adjacent |

Saaty (1993) determined scale quantitative 1 (one) to 9 (nine) to assess the comparative degree the interests of a elements against another. As the table above. The weighting for the judgment of gregarious expressed with find the mean of geometric (geometric mean from a judgment rendered by all the members of the group. Value geometric is formulated with equation

\[ GM = \sqrt[\eta]{X_1 \times X_2 \times \ldots \times X_n} \]

1.2. Do multiplication elements in a row and in nth root as shown in equation this:

\[ w_i = \sqrt[\eta]{a_{i1} \times a_{i2} \times \ldots \times a_{in}} \]

1.3. Counting a vector priority or a vector eigen and the magnitude of the weighting of each element can be obtained by equation this:

\[ X_i = \frac{w_i}{\sum w_i} \]

1.4. Counting value eigen maximum (\(\lambda_{\text{max}}\)), by means of multiplying matrix resiprokal with weights obtained, the result of a sum operation matrix is the value of eigen maximum (\(\lambda_{\text{max}}\)) with equation the following

\[ \lambda_{\text{max}} = \sum a_{ij} x X_i \]
1.5. Calculation index consistency
This calculation in mean to know consistency answer that it would affect to the truth the results. Calculation index consistency can be done by using equation

\[ CI = \frac{\lambda_{max} - n}{n-1} \]

To know ci good enough or not, needs to be know consistency ratio (CR). The ratio the consistency of a is parameter to check whether comparison in pairs has done with consequent or not using equation Under this

\[ CR = \frac{CI}{RI} \]

Value Random Indices (RI) depending on the size of matrix as shown in table 2.8. The following

| Ordo matrik | 1   | 2   | 3   | 4   | 5   | 6   | 7   | 8   | 9   | 10  |
|-------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| RI          | 0.58| 0,9 | 1,12| 1,24| 1,32| 1,41| 1,45| 1,49|

1.6. Geographic information system (GIS)
Geographic Information System (GIS) is a information systems that designed to work with the data referenced spatial or coordinate geography or in other words a sig is a system a database with a special ability to handle the referenced data into the room (spatial) at the same time as a set of operation work. The use of Geographical Information System aimed at building a system information a bridge that can be simplified and accelerate in the provision of information condition and the proposed priority for a bridge [5] major role sig is help in the planning activities and management. The one generated by sig is input in the process of planning and management. Geographical information system were divided into two groups the system manual (analogous), and automatic system (based digital a computer). The difference most basic located on how to funds. There is every indication that the use of computers to handle geographic information will continue to increase dramatically in the future and that the user base will continue to broaden. But trends in the software industry and in society more generally suggest that the nature of GIS will continue to evolve [9]

2. Research Methods
Methods used in the research by system bridge management system (bms and qualitative based on an analysis weighting elements and criteria analytical hierarchy process (ahp). In this method be a assessment of the interests of criteria with spread kusonier With involves several stake holders and decision maker, where in research by involving three factors criteria::

- Factors Condition Bridge
- Factors Volume Traffic
- Factors Policy

Of each above criteria next in the form of some sub part to form a hierarchy Matrix comparison processed using equation. Weighting received in matrix comparison carried out consistently, in measuring based on value CR. Comparison received if CR<0,1. When CR \( \geq 0,1 \) so comparison changed to meet the criteria output of process of analysis is a CR<0,1 database maintenance and rehabilitation bridge based Geographical Information System in the city Pinrang. In detail process of analysis geospatial is as follows:
1. Make layer shapefile are still in arc.map.
2. Check updating the map.
3. Processing maps and attribute-nya in ArcGIS.
4. Editing a map with use toolbar editing as append is, dissolve, merge and split tool/add vertec to make location a bridge to map.
5. Spatial namely the analysis and classification symbology display a map arc. A binder with 3 category into good, enough and broken.

6. At the end of work or hard work in format digital (Soft Copy and casts Hard Copy) covered report, mold map basic, map condition bridge, and table attribute.

3. Results and Discussion

Of the survey conducted then done inventory 13 bridge carried on two district city are Sawitto and district Paleteang obtained data as can be seen in table below.

| Number bridge | Name Bridge   | Size  | Structure over the building | NK  | Indication | Type handling |
|---------------|---------------|-------|------------------------------|-----|------------|---------------|
| 7315301       | Lompobattang  | 17    | GK BA                        | 3   | Damaged    | Rehabilitation |
| 7315302       | BauMassepe    | 32    | GB BB                        | 2   | Minor      | Maintenance   |
| 7315303       | Paleteang     | 16    | GB BB                        | 2   | Minor      | Maintenance   |
| 7315304       | Pacongang     | 24    | GB BA                        | 1   | Good       | Maintenance   |
| 7315305       | Kamp. Jaya    | 10    | GB BB                        | 1   | Good       | Maintenance   |
| 7315306       | Pawelloi      | 9,5   | GK BA                        | 1   | Good       | Maintenance   |
| 7315307       | Langnga       | 22    | GB BA                        | 2   | Minor      | Maintenance   |
| 7315308       | Beruang       | 21    | GB BA                        | 2   | Damage     | Maintenance   |
| 7315309       | Lerang-lerang | 11    | GB BA                        | 1   | Good       | Maintenance   |
| 7315310       | Maccorawalie  | 25    | GB BA                        | 2   | Minor      | Maintenance   |
| 7315311       | Corawali      | 12    | GB BA                        | 1   | Good       | Maintenance   |
| 7315312       | Kamp. Tengah  | 8,5   | GB BA                        | 3   | Damaged    | Maintenance   |
| 7315313       | Jampue        | 4,5   | GB BA                        | 1   | Damaged    | Maintenance   |

Nb :
GK = Girder Composite
GB = Girder Concrete
BA = Concrete Asphalt
BB = Reinforced Concrete

From the data we can see value damaged bridge, who into the the run would obtained 3 ( three ) the damage. Group damaged bridge in accordance technical criteria bridge, that is good - damaged, heavily damaged and critical / collapse. In accordance with a system handling bridges in this study, for the good s/d damaged and heavily damaged next Are sorted the priority scale Handling indicative conducted in bridge that has been in the survey and considered is 2 bridge to the management of heavily damaged, 5 bridge to the management of maintenance periodical and 6 of the bridge only need handling routine maintenance. While the destruction at the bridge is on element couples ( a rift, the rupture, on element concrete ( loss of concrete, crack, rupture/a partial loss of concrete, on element the flow of the river and mud sediment, garbage, scouring, on element a surface coating ( rough, crack, wavy), on element parapet (rusts, the rupture/missing, damage components, components missing , the decline in the quality of paint) , elements pipe cucuran (of the elements missing, components is congested)
Traffic
The volume of traffic flow the conversion equivalence a passenger car (emp) fluctuating daily and times in the discussion next calculation, the motor vehicle that passes through segments it consists of: Light Vehicle (LV), Heavy Vehicles (HV) Motorcycle (MC).

| Segments          | wide | LHR          |
|-------------------|------|--------------|
| 1 Bau Massepe     | 4    | 1164,5 smp/jam |
| 2 Teuku Umar     | 3    | 2284,5 smp/jam |
| 3 Bulu Paleteang | 4    | 4441,5 smp/jam |
| 4 Lompo Battang  | 4    | 2277,5 smp/jam |
| 5 Latahere       | 4    | 1158,5 smp/jam |
| 6 Beruang        | 4    | 4432,5 smp/jam |
| 7 Serigala       | 4    | 2276,5 smp/jam |
| 8 Briptu Suherman| 7    | 4468,8 smp/jam |
| 9 Wahidin Sudirohusodo | 4   | 3367,5 smp/jam |
| 10 Kamp. Tengah  | 3    | 311,5 smp/jam  |

Value
The weight with the methods AHP as outlined in sub. Chapter mentioned above applied on the implementation of the determination of the priority scale maintenance and rehabilitation bridge in Kabupaten Pinrang by using a condition of damage, traffic and policy. The weight in table above according to the analysis and next can be concluded in figure below.

| Criteria       | Sub-Criteria       | Indication               |
|----------------|--------------------|--------------------------|
| Condition (0,491) | River Flow (0,411) | Minor Damage (0,170)    |
|                | Under Construction (0,414) | Damaged (0,830)          |
|                | Building Upon (0,145) | Minor Damage (0,170)    |
| Traffic (0,185) | < 50 (0,072)       | damaged (0,830)          |
|                | 51 – 200 (0,102)   |                          |
|                | 201 – 500 (0,296)  |                          |
|                | > 500 (0,530)      |                          |
| Policy (0,324)  | Work Plan (0,237)  |                          |
|                | Developmen Plan (0,763) |                          |

Figure 3. weight a hierarchy the priority scale maintenance and rehabilitation bridge
The result of all the process start in the provision of value condition bridge, the calculation of traffic and weighting by means of a method of Analytical Hierarchy Processing in pour or displayed in a system the Geography Information System (GIS) viem several species of map as in stated in figure below determination of priority maintenance and rehabilitation bridge.

Figure 4. Map damaged bridge that is described caprice or condition of the damage to research this

4. Conclusion
Based on the results of the analysis and discussion in chapter before, so a conclusion can be drawn as follows

From the weighting of three (3) criteria through the results of kusiner from 27 respondents obtained weight each for criteria a condition of damage of 0.491 or (49.1 %), volume traffic with weights 0.185 or (18.5 %) whereas for criteria policy of 0.324 or 32.4 %. Of the result concluded that the criteria a condition of damage have the importance higher than other criteria.

Of the 13 locations bridge who are the objects in this research the scale of priority there are two (2) the point bridge that requires handling rehabilitation, for a bridge who with a condition of damage while only need handling maintenance intervals as many as six fruit bridge while 5 bridge does not require handling serious it still in good condition.

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