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EVALUATION OF THE AIR KANYUT BRIDGE CONDITIONS, BANGKA REGENCY, BANGKA BELITUNG PROVINCE USING THE BRIDGE INSPECTION METHOD DIRECTORATE GENERAL OF BINA MARGA

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Abstract— **Bangka Regency is one of the regencies in Bangka Belitung Province, which has several potentials for improving regional economies, such as agriculture and plantation, fisheries and marine, mining and industry, and tourism. Bridges have an important role in supporting activities in the sector, but there are bridges that are estimated to have critical conditions in Bangka Regency, namely, Air Kanyut Bridge. Special handling is needed in the maintenance and repair of bridges and roads, so all of activities supporting economy can run well. Bridge maintenance conducted with regular and periodic inspections, if there is damage during the inspection, then proceed with a special inspection to determine the required preservation measures. The Ministry of Public Works and Public Housing through the Directorate General of Bina Marga has a guideline used in conducting bridge inspections, namely Bridge Inspection Guidelines Number 01/P/BM/2022. The guidelines contain general provisions and technical provisions regarding the planning, preparation, and implementation of bridge inspections required for inventory inspection, detailed inspection, routine inspection, and special inspection of bridge conditions.**

Keywords— **Bridge inspection, Planning, Handling.**

I. INTRODUCTION

Transportation facilities and infrastructure play a very important role in the distribution of goods and services, including human mobility. One of the transportation infrastructures that is very important to be developed is the bridge. Bridges as an infrastructure play an important role in the traffic.

Bangka Regency is one of the regencies in Bangka Belitung Province, which has several potentials for improving regional economies, such as agriculture and plantation, fisheries and marine, mining and industry, and tourism. Bridges have an important role in supporting activities in the sector, but there are bridges that are estimated to have critical conditions in Bangka Regency, namely, Air Kanyut Bridge. Special handling is needed in the maintenance and repair of bridges and roads, so all of activities supporting economy can run well.

Bridge maintenance conducted with regular and periodic inspections, if there is damage during the inspection, then proceed with a special inspection to determine the required preservation measures. The Ministry of Public Works and Public Housing through the Directorate General of Bina Marga has a guideline used in conducting bridge inspections, namely Bridge Inspection Guidelines Number 01/P/BM/2022. The guidelines contain general provisions and technical provisions regarding the planning, preparation, and implementation of bridge inspections required for inventory inspection, detailed inspection, routine inspection, and special inspection of bridge conditions.

The formulation of the problem in this study is how the damage to each element in the Air Kanyut Bridge, Sungai Liat City, Bangka Belitung Islands Province, and how to determine the type of handling according to the bridge inspection method of the Directorate General of Bina Marga.

This study aimed to determine the damage to parts of the bridge and its elements using the Bina Marga bridge inspection method. Based on the existing damage, an analysis was conducted with the INVIJ program to determine the type of treatment needed.

II. LITERATURE REVIEW

A. Bridge

Based on its function, a bridge is a structure for crossing ravines or obstacles such as rivers, railroads, or highways, and is used for pedestrians, vehicles, or trains to cross obstacles. Based on the understanding of the bridge that has been explained, it is apparent that the bridge has a significant impact on everyday life.

Based on the structure, bridges are grouped into the upper building and the lower part of the building. The superstructure

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of the bridge is a part of the structure that functions to receive direct loads which include its weight, dead load, vehicle traffic loads, and others. The superstructure of the bridge consists of Sidewalks, Backrests and Support Poles, Pavement Raises (kerb), Pavement Floor Slabs, Vehicle Floor Slabs, Girders, Diaphragm Beams, Stiff Bonds (Wind Bonds, Transverse Bonds) and Bearings. The substructure of the bridge has the function of carrying and transferring the load from the superstructure of the bridge to a solid layer of soil. The sub-structure of the bridge consists of abutments and foundations, where the abutments can also function as bridge foundations.
The bridge is divided into many elements that are interrelated with one another. In the bridge inspection procedure, the bridge elements are divided into five hierarchical levels. The highest levels in the bridge hierarchy are bridges and wet tracks. Level 2 is divided into main elements in the hierarchy of level 3. Furthermore, level 3 is then divided into elements in a hierarchy of label 4 bridges, which are a collection of individual elements or called cluster elements and the individual elements themselves. Level 5 which is the last level in the bridge element hierarchy is an assessment at the level 4 element level, hereinafter referred to as sub-elements as elements that have location references.

B. Bridge Inspection Guidelines
Bridge inspection guidelines are guidelines compiled by the Geotechnical Center, Tunnels and Structures, Directorate General of Bina Marga, taking into account the convenience required in carrying out bridge inspections, especially those relating to inventory checks, detailed inspections, and routine inspections of bridges by updating the required explanations previously made in the 1993 Bridge Management System (BMS) bridge inspection guide and Bridge Inspection Guide no. 005-01/P/BM/2011.
The bridge inspection guidelines contain general provisions and technical provisions regarding the planning, preparation, and implementation of bridge inspections required for inventory inspection, detailed inspection, routine inspection, and special inspection of bridge conditions.
The things that are not covered in the guidelines are procedures related to the provisions and procedures for detailed inspections after a disaster, provisions for detailed procedures for special inspections, evaluation of bridge conditions that incorporate evaluation of the results of visual inspections, special inspections, and validation of bridge conditions, provisions, and inspection procedures, feasibility, and function of the monitoring bridge structure health system, provisions and procedures for detailed geometric inspection of the bridge.

C. INVIJ
INVIJ is a combination of bridge inspection methods by visual and instrumentation that uses condition assessment through vibration media which is packaged into an android and web-based mobile application. This technology makes inspecting bridges easier, increases inspection speeds, and simplifies database management.

III. EXPERIMENT AND RESULT

A. Reseacrh Method
This research was conducted through a direct survey in the field (survey) based on the Bridge Inspection Manual No. 01/P/BM/2022, which explained the stages of bridge inspection and the types of damage to each bridge component. From the survey results, the condition values of each bridge component were obtained and then analyzed using the INVIJ program. From the program, the results obtained in the form of the type of treatment that will be carried out.

B. Determination of Research Location
This study is located in Bangka Regency, Bangka Belitung Province, precisely on the Air Kanyut Bridge. The determination of the Air Kanyut Bridge as the research location is due to the importance of the Air Kanyut Bridge as traffic access in Bangka Regency, besides that, the Air Kanyut Bridge has a critical condition where the water level distance to the bridge is below 1 meter.

C. INVIJ Program Input Data Collection
Before conducting the analysis using the INVIJ program, there were several input data needed, namely inventory data and bridge condition data. Investment data was obtained through inventory checks. Inventory Check is the collection of basic administrative data, geometry, material, and other additional data on each bridge, including the location of the bridge, the length of the span and the type of construction for each span, and the characteristics of the river and the bridge widening data. Bridge condition data was obtained through a detailed inspection. Detailed inspection records all the damage that exists in the bridge elements, and assigns condition values to each element, group of elements, main elements, and main components of the bridge. The condition value for the bridge as a whole is the maximum condition value of the structural elements from the below level. The stage of examining the details of the bridge damage begins by recording any damage to the bridge elements on the survey form in the form of the element code and the damage. The position of the damage is also recorded based on its location, whether the Abutment (A), Pillar (P), and Bridge span (B). After that, the condition values were given based on the damage both in terms of structure, damage, quantity, function, and influence, where these criteria have values between 1 and 0 and are added up so that the total value per element is 0 to 5. The assessment starts from the element hierarchy, the lowest is level 5 then the level above it will be interconnected. In the field survey, it is also necessary to measure the quantity of damage to each bridge element.

D. Data Processing
In this study, data processing was conducted with the INVIJ program in the form of data processing related to the physical

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condition of a bridge so that conclusions can be drawn about what handling will be carried out on the condition of the bridge. Bridge condition data was obtained through detailed inspection, the condition values of bridge components and elements will be obtained to prepare a bridge preservation strategy and make a bridge priority order according to the type of preservation.

E. Result and Discussion

This study aimed to assess the condition of the Air Kanyut bridge, Bangka Regency, Bangka Belitung Province based on the Bridge Inspection Guidebook Number 01/P/BM/2022. From the results of this study obtained data in the form of damage to each element of the bridge which is then analyzed to determine the value of the condition of the bridge based on the damage. The results of the data analysis were processed using the INVIJ program to find out what type of treatment was needed based on the condition values obtained from the survey results. The following results from this study can be seen in Table 1.

Table 1. Air Kanyut Bridge Inspection Result Data

INVENTORY DATA		
NO	**DESCRIPTION**	**INFORMATION**
1	Bridge Name	Air Kanyut Bridge
2	Bridge Number	16.007.002.0
3	Number of Spans	1
4	Bridge Length	12,1 meter
5	Bridge Width	7,8 meter
6	Building Type	GTI (Indonesian Reinforced Concrete Girder)

BRIDGE CONDITION VALUE DATA					
Element	**Damage Type**	**Location**	**NK Level 5**	**NK Level 4**	**Quantity**
Main Water Stream	Excessive Sediment/Mud	B1	4	4	120 m3
Retaining wall	Broken or missing parts	A1	4	4	5,4 m2
Retaining wall	Broken or missing parts	A2	4	4	6 m2
Wall pillar / Column	Hollow/sounding concrete	P1	3	3	1,2 m2
Wall pillar / Column	Cracked	P1	3	3	0,8 m
Wall pillar / Column	Cracked	P2	3	3	3,6 m
Girder	Hollow/sounding concrete	B1	3	3	0,8 m2
Girder	Cracked	B1	3	3	12 m
Floor plate	Hollow/sounding concrete	B1	2	2	1,4 m2
Floor plate	Cracked	B1	2	2	14,7 m
Sidewalk	Cracked	B1	3	3	1,6 m
Drain pipe	Clogged drain pipe	B1	3	3	4 pcs

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Floor Drainage	Clogged drain pipe	B1	2	2	2 pcs
Surface Layer	Rough Surface	B1	1	1	98 m2

BRIDGE CONDITION VALUE DATA					
Element	**NK Level 3**	**Element**	**NK Level 2**	**Element**	**NK Level 1**
River Flow	4	River Flow / Heap	4		
Security Building	4				
Head of Bridge / Pillar	3	Lower Building	3	Bridge	4
Girder System	3	Upper Building	3		
Floor System	2				

Based on the results of the examination of the condition of the Air Kanyut bridge, it was found that the value of the condition of the bridge was 4 where the bridge was in a critical condition which means there is dangerous damage because the bridge components were in critical condition and require immediate treatment.

IV. CONCLUSION

A. Conclusions

The conclusions from the evaluation of the condition of the Air Kanyut Bridge are as follows::

1. The damaged elements were the main water flow, retaining walls, wall pillars/columns, girders, floor slabs, pavements, drain pipes, floor drainage, and surface layers;
2. The value of the condition of the Air Kanyut bridge was 4, where the value of the condition is the bridge was in critical condition, which means there is dangerous damage because the bridge components are in critical condition and require immediate treatment;
3. Based on the output that has been issued by the INVIJ program, the Kanyut Air Bridge needs to be handled in the form of replacing the bridge, because it is no longer possible to raise the water level to the bridge.

B. Recommendations

Based on the conclusions that have been obtained, the suggestions that can be submitted from this research are:

1. Based on the evaluation result of the Air Kanyut bridge condition, the bridge needs to be handled as soon as possible considering the increasing rainfall every year and the unfavorable condition of the structure;
2. It is necessary to design a replacement for the Air Kanyut Bridge according to the water level and the use of anti-corrosive materials.

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