Assesment Of The Air Putih Slab Bengkalis District, RiauProvince (Case Study: RORO Air Putih Wharf)

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Abstract. A pedestrian bridge is one of the important things that people need to cross from one island to another. However, there is one element called the slab on the bridge that requires special attention and its strength is important to always reviewed periodicaly because it holds the bridge from collapsing. This review can take the form of a visual review or analysis. Visual inspection can use the guidelines developed in the Bridge Management system in 1992. In BMS 1992, the review is carried out based on the final score, where each score represents the condition of the bridge, the higher the score obtained, the more dangerous the bridge is. This research carried out two stages of analysis, which included a visual inspection and an analysis of the load that the pier could withstand. This research carries out finite element analysis by modeling the slab on the bridge according to factual conditions. This modeling is carried out by analyzing one slab segment and finding out how much deflection occurs when a load is applied to the slab. Research shows that when a vehicle is loaded at 35069 N/mm2, a displacement of 0.797 mm is obtained. Meanwhile, with visual testing using dial gauge data processing, a deflection of 1.26 mm was obtained. There are differences between visual analysis and modeling analysis. This can occur because of differences in quality and field implementation when the slab was made. So it is necessary to check periodically whether the condition of the bridge immediately requires further special treatment or whether it can be postponed for some time.

Keywords: Bridge-Slab Assessment, Finite Element Analysis, Visual Test, Abaqus CAE

1 Introduction

Bengkalis District and Bantan District which are located on Bengkalis Island, Siak Kecil District, Bukit Batu, Mandau and Pinggir, Bathin Solapan, Talang Mandau, Bandar Laksmana which is located on the island of Sumatra and Rupat and Rupat Districts North is located on Rupat Island. Means of transportation from Bengkalis Island to Sumatra Island can use a passenger ship (ferry) with the Bengkalis - Dumai - Long Strait - Tanjung Balai - Batam route. In addition, there are Roll On Roll Off (RORO) ships, namely ships that can transport goods and two-wheeled and four-wheeled vehicles to Bengkalis Regency.

There are four piers used for the RORO crossing, namely two piers at Air Putih and two piers at Sei Selari. There are often long queues for users of these crossing services, especially during national holidays, and this triggers public disappointment because the facilities at the port are inadequate to accommodate a large number of people.

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Behind the four wharves currently operating, there are also 6 RORO vessels operating alternately using shifts, 4 of which are actively operating every day and 2 stand-by vessels waiting for the replacement schedule. And that is very helpful in speeding up the crossing process, without the occurrence of very long queues of passengers. For the time to maneuver the ship itself from when the ship is almost arriving and docking at the pier, it takes approximately 15-25 minutes, depending on the type of ship that is coming and the conditions of the tide or ebb of the sea water itself. The time needed for the RORO ship to unload cargo takes 15 minutes, and the time for filling and preparing passengers and passenger vehicles takes 25-30 minutes, until the ship releases the rope from the pier and departs.

Even though there are two piers at Air Putih port, problems often occur at piers two which result in delays in departure times at the crossing. Therefore, many vehicles experience queues, both those using two-wheeled motorcycles and four-wheeled vehicles [2]. The disappointment of the ferry service users cannot be separated from a number of conditions, one of which is the inadequate pier infrastructure. This has an impact on the emergence of several perceptions that tend to be negative from users of the crossing service. There are several obstacles such as the occurrence of cracks in the main structural parts of the second pier. In addition, if the seawater recedes, the pier cannot be used because ships cannot lean on the pier. This of course has an impact on the longer queues at the Air Putih wharf because only one wharf is operating.

2 Research Method

The study, the writer conducted study at *RORO* Air Putih, Bengkalis District Riau Province. The object of this study was comparison between the results of field tests and the results of analysis at Abaqus CAE from the condition of the slab structure at the Air Putih ferry port pier. The type of this study was descriptive. The type of data used in this study is qualitative data. Sources of the data used for this study namely primary data and secondary data. The data collection technique of this study namely observation, and documentation.

3 Result and Discussion

3.1 Visual Test Result

The condition assessment for the damaged element consists of a series of five questions regarding the damage present. The detailed condition value of the bridge is given in accordance with the BMS guideline for bridge inspection by the Directorate General of Highways, Ministry of Public Works of the Republic of Indonesia. From the results of a visual inspection of the condition of the slab in the trestle area visually there is damage in the form of honeycomb so that the condition value of this structure is 2.

Table 1. Trestle slab condition value

Score for	Criteria	Score	Information
Structural (S) Damage (R)	Dangerous	1	
Development (K)	Not harmful	0	v
	Reached until severe damage	1	v
	Achieved until light damage	0	
	extends > 50% or more affects the damage	1	v
	Does not more of 50% the damage	0	
Function (F)	Element not working	1	
	Elements work	0	v
	Not influenced by other elements	0	v
Final Score (NK)	NK = S + R + K + F + P	0 - 5	2

Fig. 1. Slab trestle elemental visual condition

Source: 2023 Thesis Documentation

From the results of tests carried out by Visual Test, the damage that occurs to the structural elements of the pier slab is a type of Honey Comb damage, where the damage occurs due to peeling of the concrete cover. Then a value of two is obtained for the pier slab structural elements, in which the structural elements are damaged which requires periodic monitoring or maintenance

3.2 Data Analysis and Processing

3.2.1 Additional Data

Form data of a wharf document report obtained from a previous survey conducted by the Department of Transportation in the past.

3.2.2 Primary data

The primary data that has been obtained on the conditions in the field are:

1. The largest weight of the trucks passing through the test area was the Mitsubishi Canter125PS 6 Ban cold diesel oil truck with an empty payload weight of 3400 kg.

Fig. 2. Truck vehicle weigh
Source: 2023 Thesis Documentation

2. The reading data on the Dial Gauge deflection that occurs is 1.26 mm on the structural elements of the pier slab, where the results are obtained from vehicles that pass above it, namely Mitsubishi Canter 125PS 6 tires cold diesel oil trucks with an empty load weightof 3400 Kg or equivalent to 3.4 tons
3.

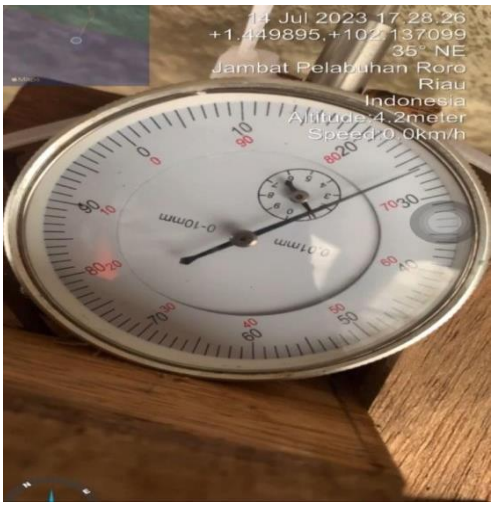

Fig 3. Dial gauge reading results

Source: 2023 Thesis Documentation

3.3 Modeling Using the Abaqus CAE Application

The data to be input in the abaqus modeling is as follows:

1. Material Quality

The quality of the concrete used in this analysis is in the form of core drill data from field testing conducted by the Transportation Agency, which obtained a value of 25.86 MPa. Then for the quality of reinforcing steel using BJTP 24 (fy = 240 MPa), the diameter of the reinforcement use dis 16mm.

Table 2. Concrete quality

Number	Location	Element of Structure	Fe' Core Drill Test (Mpa)
1	*Air Putih* Ferry port dock	Balok	18.52
2		Pilecap	14.86
3		Slab	25.85

Table 3. Concrete Plasticity

Dilation Angle	Eccentricity Parameters	Fb0/fc0	K	Viscosity
31	*0.1*	1.16	0.667	0

Source: Abaqus Modeling 2023

Table 4. Compressive Behavior

Yield Stress	Inelastic Strains
11	0
25.4224	0.002
24.3913	0.0023
23,178	0.0025

Source: Abaqus Modeling 2023

Table 5. Concrete Tensile Behavior

Yield Stress	Viscosity
3.12	0
0.2342	0.0011

Source: Abaqus Modeling 2023

2.Modeling Dimensions

The dimensions of the slab size used are 4600x2700mm, slab thickness is 280 mm and rarely between reinforcement is 150mm. These dimensions are obtained from the results of measurements in the field and the results of the Reebar Scanning test.

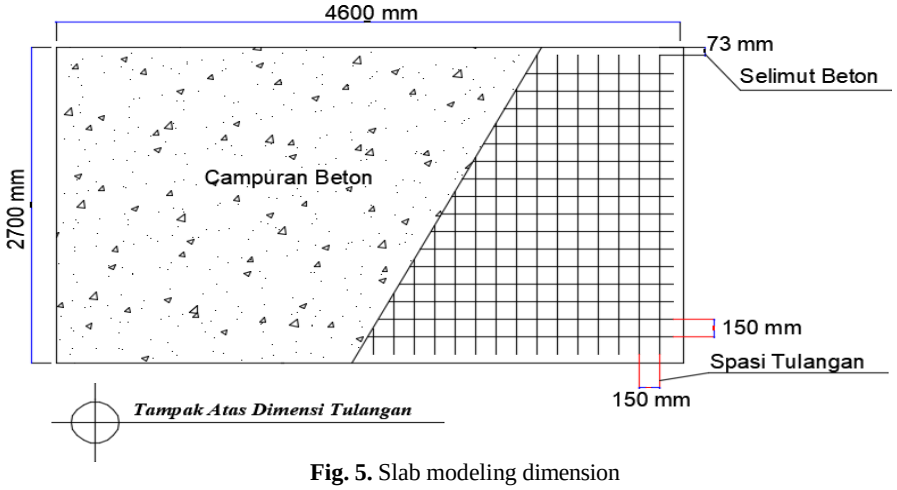

Fig. 5. Slab modeling dimension

From the input data above, the deflection results obtained after analyzing the Abaqus CAE software are as follows:

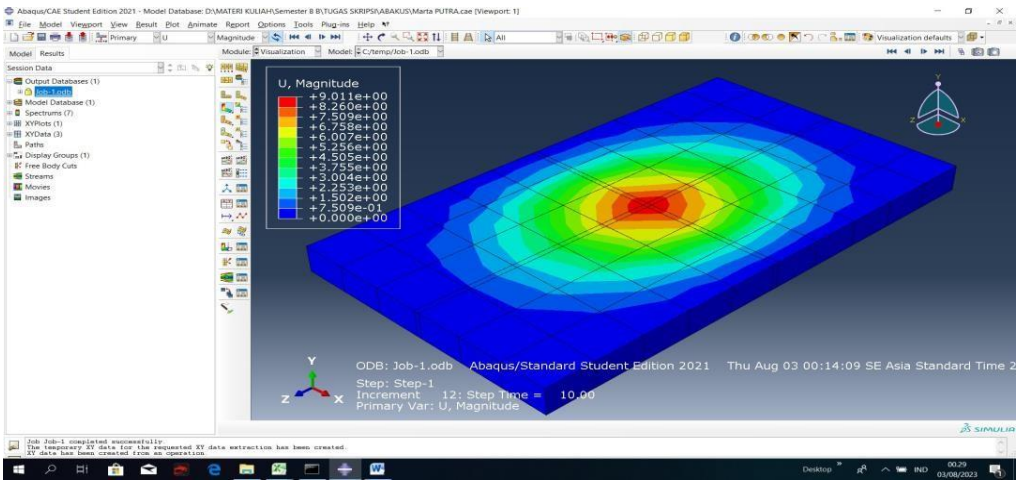

Fig. 6. Deflection on normal slab

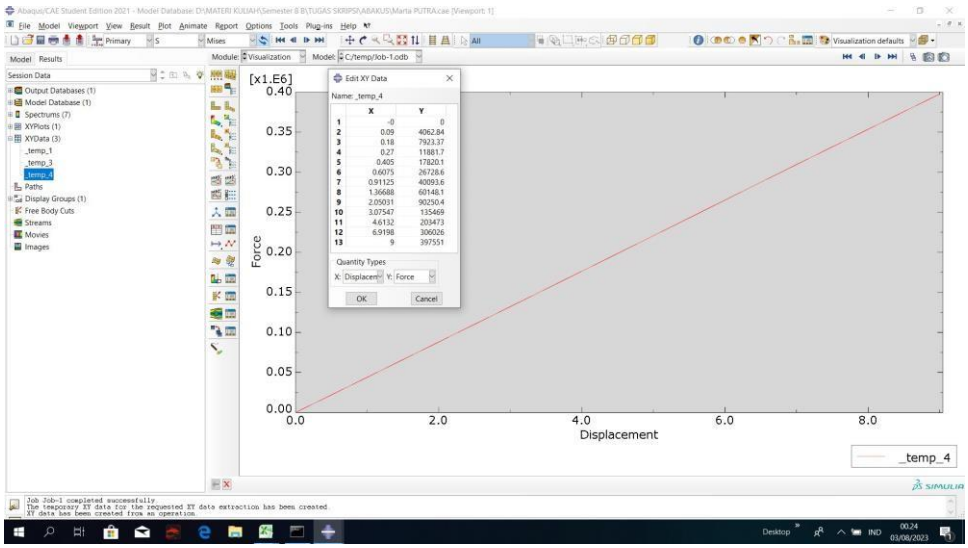

Fig. 7. Existing load and deflection graphs on abaqus

4 Conclusion

This chapter contains the conclusions and suggestions for the results of the Assessment of the Structure Test of the Air Putih Crossing Pier as follows:

1. Examination of Visual Test results. It required periodic monitoring or maintenance.
2. Examination of Dial Gauge Test Results. From the test results in the field shows deflection is 1.26 mm, with the load of trucks passing above it weighing 3400 kN.
3. Examination of Abaqus CAE Software Modeling Results

Modeling carried out using the Abaqus CAE software aims to compare the deflection between what occurs in the field and in this application, and after modeling with existing data, the resulting deflection is 0.797 mm with a weight of 3400 kN.

The suggestions that can be given as consideration in this study or can be used as consideration in conducting other research are as follows:

1. Immediately make repairs to the damaged elements of the wharf structure. Repair existing cracks.
2. Repainting steel elements that have been corroded
3. Always maintain cleanliness in all areas so that early detection can be carried out if damage occurs.
4. Perform routine maintenance such as painting structural components.
5. Conduct structural inspection every 5 years and the review used in this study is an insight for future software application from the concept of the finite element method as an analysis, while the model to be used should be properly calibrated with experimental data so that it will provide the right modeling parameters for later use.

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