DESIGN OF A METAL MATERIAL CORROSION RATE TEST TOOL AS A SUPPORT FOR MARITIME INDUSTRY OPERATIONS AT THE CENTRAL JAVA SEA PORTS

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Abstract. Indonesia is one of the countries that has a vast ocean so that Indonesia is also called a maritime country. The sea transportation sector is a very important element in the development, distribution and unity of the population separated by the ocean. Ports are an important part of sea transportation services such as berthing, loading and unloading goods, loading and unloading passengers and export and import services. One of the damages to port infrastructure is corrosion. This research aims to make a corrosion test tool that can be used to calculate the corrosion rate of metals such as steel, aluminium, copper and brass. The results of making a corrosion rate test tool can be used by maritime industry players in carrying out maintenance and repairs, predicting the life of tools made of metal that can be corroded by corrosion environments such as the sea and ports, so as to avoid work accidents due to infrastructure damage and increase the age of port infrastructure made of metal by repairing and maintaining before the equipment is damaged.

Keywords: port, corrosion infrastructure, sea transportation

A. Introduction

Indonesia is an archipelago consisting of thousands of islands separated by oceans. Indonesia is geographically located from 60°N to 110°N and 920° to 1420°E, consisting of approximately 17,504 large and small islands. Three-quarters of its territory is sea (5.9 million km^2), with a coastline of 95,161 km, second only to Canada in length.[1] The role of sea transportation carried out by ships is very important in connecting, uniting the community, equitable development and distribution of goods in the economy from one island to another. [2]. Ships in their operations need a port as a place alongside to load and unload goods and export-import processes at ports that have high economic value, up and down passengers from ships and places to fulfill ship needs such as: fuel, fresh water and logistics [3]. The picture below shows the situation of the harbor.

Figure 1. Tanjung Emas, Semarang ports

In serving the needs of ships, the port area has a lot of facilities including: Cade, loading and unloading equipment, warehousing, docks, electrical installations, fresh water installations, refueling facilities and garbage disposal to provide convenience in maritime activity services commonly referred to as the maritime industry. [4] Damage that often occurs in maritime industry facilities due to their location in corrosive environments, especially infrastructure facilities made of metal, is corrosion. Corrosion is a decrease in the strength properties of materials or metal materials due to interactions with the environment. These environments are such as acids, water, temperature changes, and weather conditions.[5]

Corrosion damage, especially in the maritime industry environment, can be prevented and inhibited by maintenance, repair of metal infrastructure in ports with corrosion protection and corrosion rate calculation. [6]

This study focuses on the design of making corrosion test equipment with coupon and weight loss methods so that this corrosion test equipment can be used by the maritime industry in carrying out maintenance, repair, protection, prediction of the life of infrastructure made of metals that are highly susceptible to corrosion.

B. Methods

This research uses several methods including:

1. Writing method

This writing uses a qualitative descriptive method. Where a qualitative descriptive approach is a problem formulation that directs the author to explore and portray a social situation to be studied thoroughly, thoroughly and in depth. [7] Qualitative approach is a method of activity that produces descriptive data in the form of written and spoken words of people and observed behavior. Qualitative activities focus on social phenomena and reveal the feelings and perceptions of the participants studied. This is based on the belief that knowledge is generated from the social environment and that understanding social knowledge is a legitimate scientific process. This qualitative approach aims to obtain complete information about the matter of "knowing and monitoring the Corrosion Rate of Metal Materials on the Central Java Port Infrastructure".

2. Data collection technique

Data collection techniques are the processes and methods used by the author to obtain the required data. In any type of research, whether qualitative or quantitative, techniques are always used to collect the necessary data. The aim is to help the author obtain accurate data.

a. Observation

The author uses observational data collection techniques. Observance or observation can be defined as attention that is focused on an event, symptom, or a matter. [8] We conclude that observation is the activity of directly investigating the environment of the object of research, collecting data and forming a clear picture of the object of research. Observation is carried out by visiting or traveling directly to the Port of Tanjung Emas Semarang and Central Java as part of this research.

b. Literature Study

Literature research is a series of activities related to library data collection, reading and recording, and managing research materials. A literature review is a survey conducted by a researcher to collect a collection of books and journals related to a problem or research objective. [9] This method is carried out with the aim of revealing various theories related to the problem under study / research as a reference for discussing the results of the research. Another definition of library research is looking for theoretical references related to the case or problem found. In general, studying literature is a way to solve problems by looking for literature that has been written. In other words, the term literature study is also familiar with the term library science. In conducting research, of course, the researcher must have extensive knowledge of the subject he is researching, otherwise the research is bound to fail at a high rate. This writing is based on a literature study on corrosion rates, especially on metal materials.

c. Weight loss method

The weight loss method is a method of testing the corrosion rate by calculating the weight of the metal before it is corroded and after it is corroded using a scale that has been calibrated, the results of the weight difference are calculated using the American standard equation formula with a serial number. ASTM D 2688-05 [10]

d. Coupon installation method.

The coupon installation method is a method of calculating the corrosion rate of metals by taking samples made into specimens of the appropriate size according to the American Society for Testing and Materials (ASTM) which are then inserted into the coupon installation corrosion test equipment.

C. Results And Discussion

1. Sea Ports

Port is a place consisting of waters and land with certain boundaries and is used as a place of government activities, service activities, and defence. The main function of the port is to allow ships to dock or anchor, to dock or anchor, and to raise and lower passengers to disembark, export, import, loading and unloading of goods, and internal transfer between modes of transportation. In its daily operations, the port has shipping safety protection facilities and other supporting facilities to ensure maritime industry activities run smoothly. This research focuses on ports in the Java Sea, among others: Tegal port, Batang port, Kendal port, Semarang gold cape port, Jepara port, Pati port and Rembang port. From the results of previous research it is known that seawater in the port contains high salinity which results in corrosion. The picture below is the activity of the Semarang gold cape port.

Figure 2. Ports Tanjung Emas Semarang activity

2. Corrosion rate.

In research conducted in the waters of the Semarang gold cape, it is known that metals that are in a corrosive environment experience a rapid corrosion rate so that it is necessary to calculate the corrosion rate so that there is no damage to the metal.[11]

3. Design of corrosion test equipment.

Metals that are in a corrosive environment experience degradation due to corrosion rates. Corrosion rate calculations are easier to do using corrosion test equipment according to ASTM D 2688-05 standard coupon installation section. corrosion test equipment design can be seen in the figure below:

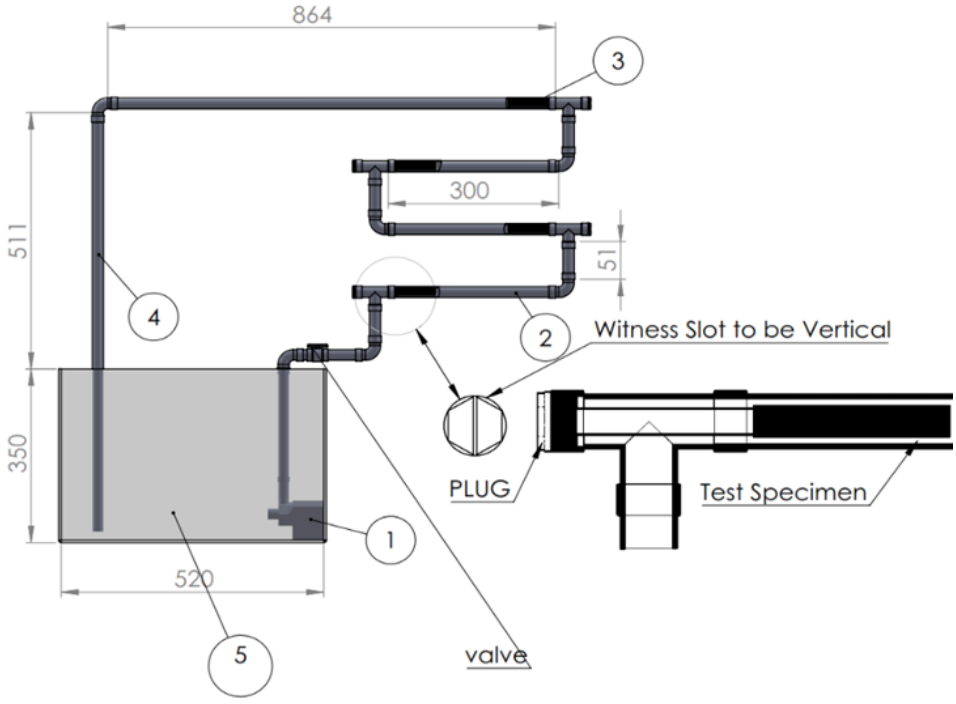

Figure 3. Design of corrosion test equipment

D. Conclusion

This research can be concluded that all metal operational infrastructure of maritime industrial activities that are in a corrosive environment, especially in the Java sea port, experience corrosion which can cause damage. Prevention of damage to the maritime industry infrastructure in the port can be done by calculating the corrosion rate using a corrosion test tool designed by the researcher.

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