Sustainable design for passage boat ports in remote areas in era construction 4.0 at sidoarjo east java indonesia

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Abstract. Recently, human life is inseparable from the name of transportation. The transportation industry is also progressing quite rapidly in term of design, technology, comfort and safety. However, the research location at Tegal Sari Jabon District Sidoarjo, the transportation of a passage boat which lack of security when access to the boat resulted in many undesirable things such as the boat upside down and drifted, two-wheeled vehicles entered the river, and people slipped. Thus, the goal of this research is to design a pier and provide safety around the boat and expected to be a solution to reduce unforeseen events. The methodologies carry out during this research are including survey, measurement primary data concerning revolution 4.0, numerical hydrodynamic simulation and design of the safe harbour and eco-friendly. The outcomes of this research project demonstrate that it is necessary to update the design of the dock with suitable in all conditions which consider numerical hydrodynamic modelling simulations. Supported by measurement devices of the hydrodynamic data based on industrial revolution 4.0 such as drones and deeper smart sonar. The researchers can figure out the maximum tide and ebb that will occur more cheap, easily and efficiently rather than using conventional measurement techniques.

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Keywords: *passage boat, transportation, drone, port, era construction 4.0*

1. Introduction

Nowadays, humans are going to continue to move from one place to a place for working, studying or do a hobby. Transportation exists to help the process of moving passengers and goods from one place to another [1]. On the Porong River located in Tegalsari Hamlet, Jabon District, Sidoarjo, there is traditional transportation called a passage boat.

A passage boat is traditional transportation of water used in areas and villages adjacent to rivers [2]. Figure 1 shows the passage boat well known in the surrounding community because, by the fare of 3000 rupiahs for a single trip, it can cut travel time rather than over land, and can transport the community along with their motorbike or bicycle at the same time. But all of these positive values are unfortunately not matched by the condition of the boat or dock. The condition of the pier is fragile, slippery and there is no grip around, and the condition of the boat is far from comfortable.

Figure 1. Passage Boat on Porong's river.

There have been many accidents that have occurred such as many people slip when they want to get on the boat, and the worst was the incident of the motorcycle residents into the river. As a civil engineer see transportation engineering as "the utilization of technology and scientific rules to the planning, functional design, operation and management of facilities for any mode of transportation in order to provide safe, efficient, fast, comfortable, convenient, economical, and environmentally compatible movement of people and goods " [3].. Thus, the purpose of this research is to make the pier design safer and more comfortable with a sustainable concept.

2. Background and experimental setup

The industrial revolution has now entered the 4th generation. The 4th generation which conceptualises Cyber-Physical Systems, the Internet of Things and Internet Service will make it easier for humans to get data and information easily [4].. Technological developments in the industrial revolution era 4.0 have produced many tools such as drones and deeper smart sonar, where these devices can not only be used for fun but can also be used in data collection for civil engineering.

Ocean tides are waves generated by interactions between the earth, the sun and the moon. Peak waves are called high tides (High Water / RW) and valley tides are called low tides (Low Water / LW). The vertical difference between high tides and low tides is called the tidal range [5]. There are actually three basic types of tides based on their period and regularity, namely diurnal type tides: within 24 hours, there are 1 tide and 1 tide. Tides of the daily double type (semi-diurnal type): within 24 hours there are 2 tides and 2 tides. Tidal type mixed type (mixed tides type): within 24 hours there is a mixture that tends to form a single daily type or skewed to a double daily type [6].

Sustainability, defined as "meeting the needs of the present without compromising future generations to meet their own needs" [7]. The goal of sustainable structural design in the production of a structural system that meets the needs of the owner and user while minimising the environmental impact and conserving resources where possible [8]. It can be said to be a sustainable material if materials are obtained from nature such as wood and bamboo, which can be recycled materials such as aluminium, copper and other metal materials [9].

This research starts with a survey in the form of questions and answers to the community about how they feel when using this service and what are their future expectations for this boat passage? Of the 20 communities, 70% say they are afraid when using, and many of them expect an increase in the dock in terms of safety and comfort. It can be seen in Figure 2, taken using a drone, the passage boat used far from the security. After conducting the survey, then continued by taking direct measurements in the field using deeper smart sonar as shown in Figure 3. Based on Deeper, UAB (2016) deeper smart sonar pro + developed by Deeper company, uses a frequency of 290 kHz to get the highest bathymetry accuracy with a maximum measuring depth up to 80 meters [10].

Figure 2. Passage Boat Photo from Drone

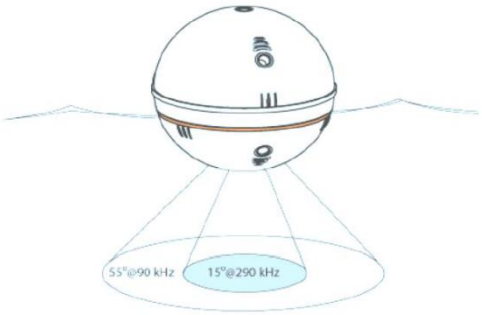

Figure 3. Deeper Smart Sonar Pro +

By the method of deploying deeper smart sonar with a string and let the ship run about 5 km/hour as can be seen in Figure 4. The output results show in Figure 5, it can be seen at www.mapsdeepersonar.com and can be extracted to the form of a .csv file which is the longitude-latitude (XY) coordinates and z depth.

Figure 4. The deployment of deeper smart

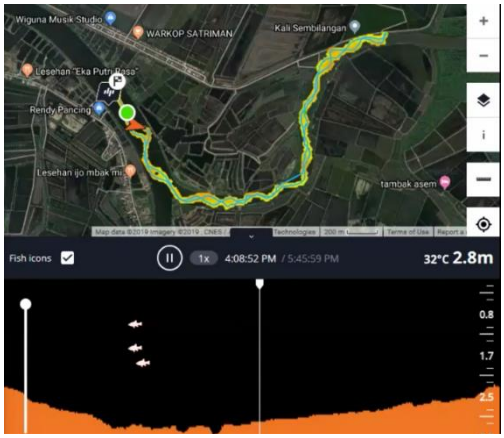

Figure 5. Output of the deeper smart sonar

After that, the data is processed using an application called Delft 3D open source. Create a grid with M-Refinement factors and N-Refirenement factors of 2 each and leave the grid only for the water level as shown in Figure 6. Then create a depth sea level in the QUICKIN menu like Figure 7 and simulate a critical time for two weeks simulation from 23 December 2017 till 6 January 2018.

Figure 6. Grid untuk Daerah Perairan

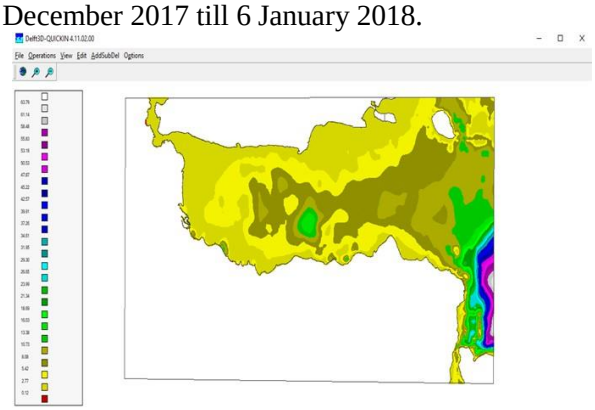

Figure 7. Depth Sea Level

3. Research results and discussion

The simulation results in the Porong river, obtained several results. From Figure 8, the grid used averaged 450 m with a number of grids of 249,804. It is known that the highest tide point occurred on January 2, 2018 as high as 2 meters and the lowest ebb was -1.8 meters. From Figure 9, the grid used is an average size of 100 m with a total of 13,416 grids and it is found that the average fast tide current in the west for 2 weeks is around 1.5 meters / second

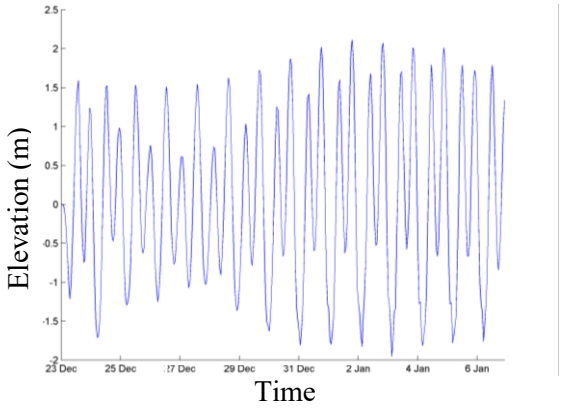

Figure 8. Water Level during critical time

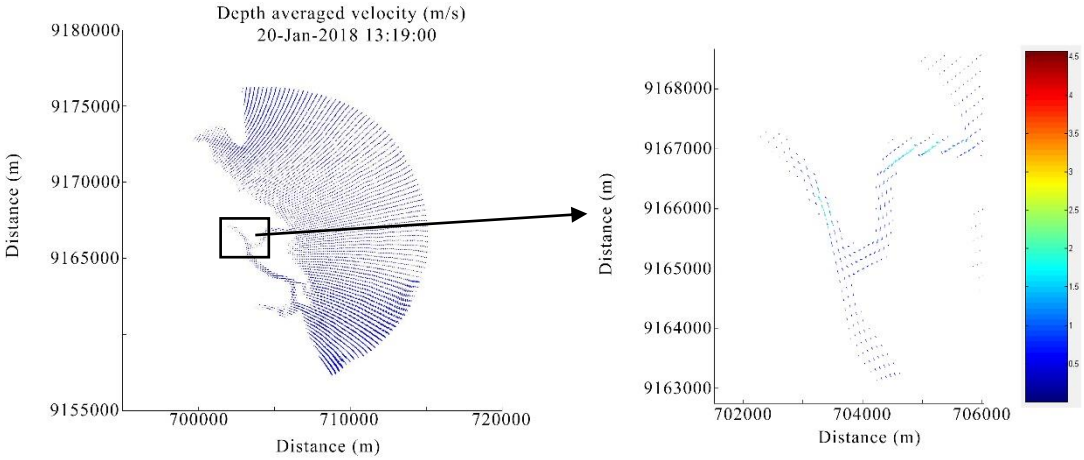

Figure 9. Depth Average Velocity during critical time

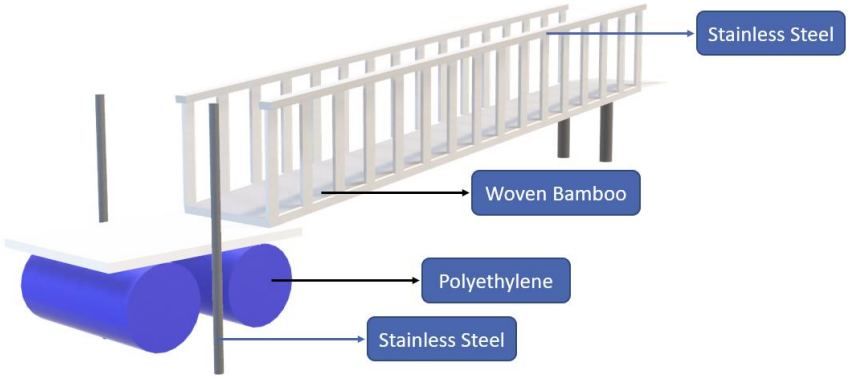

Figure 10. Pier Design for passage boat

As can be seen in Figure 10, after the results of data processing, the pier design was made using sustainable materials such as stainless steel for handrails, basic structures and stiffeners and also using anti-chemical reservoirs which are claimed to have more resistance than those made of stainless and fibre in general. The use of woven bamboo to reduce community risk is slipping, and it hoped that this design could use at maximum tides.

4. Conclusion

The boat passage located in Tegalsari sub-village has become an alternative way as well as income of service providers. Therefore it is necessary to update the design of the dock that is suitable in all conditions by making hydrodynamic modelling simulations aided by tools based on industrial revolution 4.0 such as drones and deeper smart sonar, we can find out the highest tides and lows that will occur more easily and efficiently use these tools rather than using conventional measurement techniques.

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