

Study on Sediment Depository due to Detached Breakwater in Tropical Peat Coast of Bengkalis Island Indonesia

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ABSTRACT

Bengkalis Island is in Indonesia, which lies at 1° 15' LU - 1° 50' LU and 102° 00' BT - 102° 30' BT and it lies along the west side of Malacca Strait. More than 70% of its area is covered by peat soil, and it is now endangered by coastal erosion and landslide. In previous studies, total coastal erosion extent of 478 ha in the past 15 years, representing peat volume loss of 21.74×10^6 m³ which correspond to total carbon loss of 1.28×10^6 ton (Haidar et al., 2015). This phenomena has been experiencing severe coast erosion process since 1955 when Bengkalis Island was protected by mangrove forest (US Army Service., 1955) which is function as a natural barrier against coastal erosion. Usually in the ideal situation, the coast is protected by a healthy mangrove ecosystem which has variety of flora and fauna (Stieglitz et al., 2000). However it is become causes issue in order to replanting mangrove tree near shoreline due to hydrodynamic forces such as wave, wind, water level and current. Detached breakwater is needed. The main function of a detached break water is to reduce the incident wave energy on embayment and, thereby, to reduce the net sediment transport rate in the sheltered area. In this way, detached breakwaters promote the sediment deposition in the lee (Khuong., 2016).

This paper has studied of sediment depository due to detached breakwaters from the assessment of the existing breakwater that had been installed at northern part of Bengkalis Island. Novel techniques is used for coastal monitoring assessment in which combine with coastal engineering and geo-informatic activity. The

wind-wave data are analyzed in short-term statistics, the short-term data analysis is indicated wind-wave intensity in each direction with 16 sectors provide by Meteorological station with SESAME web system. The wave bathymetry nearshore base on bathymetry survey and General Bathymetric Chart of the Oceans (GEBCO2014). Structure physical data of breakwater such as structure parameter, physical condition, sediment properties, aerial images and shoreline changes will be collected using Geo-informatic activity like both terrestrial survey and drone survey.

The models start with findings of the basic relationships of the sediment depository due to detached breakwater. The new relationships are developed to estimate the depository of tombolo, salient and limited response for the shoreline backward and upward breakwater. Analyzing the relationship will found a new understanding of the estimation of detached breakwater's behavior on Sediment Depository especially in tropical coast of Bengkalis Island Indonesia.

For numerical model there are new process-based model for the nearshore and cost developed by (Roelvink et al., 2009) called X-Beach. It is an open-source numerical model which is originally developed to simulate hydrodynamic and morphodynamic processes and impacts on sandy coasts with a domain size of kilometers and on the time scale of storms. Since then, the model has been applied to other types of coasts and purposes. The model includes the hydrodynamic processes of short wave transformation (refraction, shoaling and

breaking), long wave (infragravity wave) transformation (generation, propagation and dissipation), wave-induced setup and unsteady currents, as well as overwash and inundation. The morphodynamic processes include bed load and suspended sediment transport, dune face avalanching, bed update and breaching. Effects of vegetation and of hard structures have been included. The model has been validated with a series of analytical, laboratory and field test cases using a standard set of parameter settings. The X-beach model has already been shown to accurately reproduce spatially-varying overwash responses on Santa Rosa Island, Florida, during Hurricane Ivan (McCall et al., 2010) which leads to confidence that it is a useful tool to solve these cases.

KEY WORDS: Breakwater, tropical coast, shoreline changes, novel technique, Aerial Image, XBeach, Surfbeat mode