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Extended Abstract

Analysis of Submarine Cable Route using Singlebeam Echosounder Data. Case Study: Gili Iyang's strait.

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Abstract- A comprehensive hydro-oceanographic survey is important for suitable submarine cable design and installation method. The installation needs an accurate bathymetric data of seabed. Since, those data are currently not available in Gili Iyang strait, a survey to measure primary data was needed. In this research, the referenced depth data to Lowest Water Level of tidal at Gili Iyang was measured by Singlebeam echosounder. Therefore, From the analysis based on the criteria of installation of submarine cable route, cable line alternative-2 was the most suitable with length of 5.468 m (direct distance) and 6,775 m (slope distance).

Index Terms – Bathimetry, Cable route, Singlebeam Echosounder.

INTRODUCTION

The sufficient electricity supply is one of the most important infrastructures and vital necessities to support the welfare society in the small islands of Indonesia. Gili Iyang Island is located in the east of Madura. It is one of small islands that still suffered from lack of electricity supply. For doing daily activities, its inhabitant are strongly depend on diesel fuel engine generator and solar cells. Therefore, the local government has plans to transmit electricity through under water from nearest mainland (Madura Island).

To support the governmental plan, a comprehensive hydro-oceanographic survey is needed for suitable submarine cable design and installation method [1]. The installation needs an accurate bathymetric data of seabed. The data was provided by sea bottom topography mapping through a depth measurement survey to obtain a 3D model of bottom surface. The goal of this research were to make bathymetric map and to design optimal route for submarine power cable.

METHODS

The research took place in Gili Iyang strait Dungkek-Sumenep. Geographically in 114° 9'59.79" - 114° 6'51.63" E and 6°57'41.03" - 7° 0'29.48" S.

The bathymetric survey was conducted on October 15, 2015 by measuring three parameters simultaneously; the depth measurement, position measurement of the depth, and measurement of tide. Depth measurement and position ware recorded by *Singlebeam echosounder*. Hydrographic surveys was carried out based on the IHO standard for hydrographic survey (S.44 - IHO) [2]. Theoretically depth measurement is calculated by equation (1). By calculating time interval when the waves emitted and received back (Δt), the distance (H) from the seabed relative to the transducer are [3]:

$$H = \frac{c\,\Delta t}{2} \qquad (1)$$

Analysis of bathymetric and submarine cable route was performed using spatial analysis tools in ArcGIS 10.3. Depth contour information obtained from bathymetric map used as a reference for submarine cable routings. Criteria of submarine cable routings are: 1) cable should be safe and facilitate installing process, and 2) cable has the shortest route.

RESULTS AND DISCUSSION

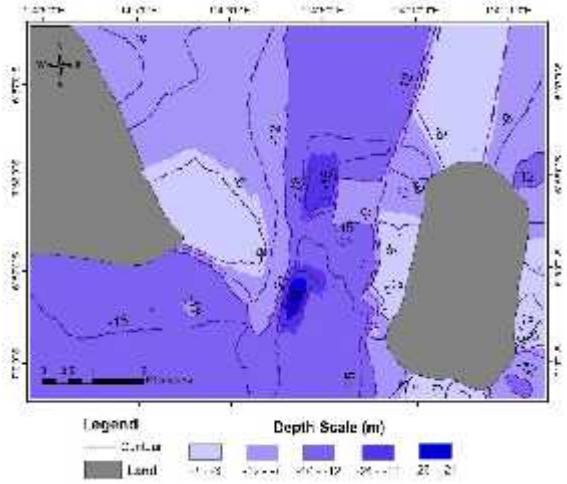

FIGURE1. BATHYMETRIC MAP

Figure1 shown that the shallow sea occurred on the coastal area while deep sea are in the center of strait between two islands. The minimum, maximum and average depth are 3 m, 26 meters and 11,6 m, respectively.

Based on data in figure 2 and 3 three alternatives of cable route were designed following two criteria for submarine cable routing. By using the tools of 'calculate geometry' in ArcGIS software, the length of three routes were calculated. The three alternatives were presented in figure 3 and table 1.

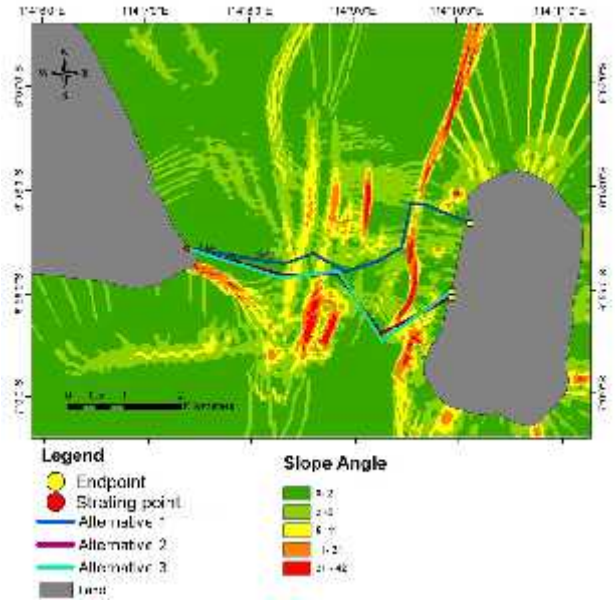

FIGURE2. SEABED MAP AND CABLE LINE BASED ON TILT

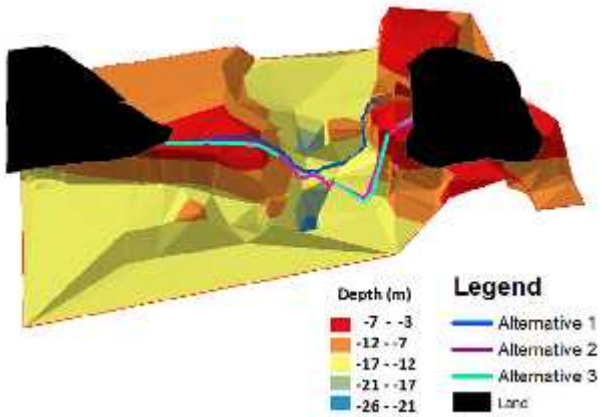

FIGURE 3. 3D MODELLING OF SEABED

TABLE 1. LENGTH OF CABLE LINES

No.	Name	Distance (m)	
		Direct	Slope
1	Alternative 1	5,986	6,842
2	Alternative 2	5,468	6,775
3	Alternative 3	5,788	7,484

Length of alternative cable routes ware presented in table 1. The shortest of direct and slope distance is alternative 2. Those were 5,468 m and 6,775 m. Slope distance was longer than direct distance as that was the actual length of the slope following the seabed surface. Submarine cables in this research are not planted in the ground, but only placed on the surface of the seabed.

CONCLUSSION

According to the selection criteria for these three submarine cables routes, cable lines alternative-2 (purple) has met the criteria. Therefore, it can be concluded that the shortest route of submarine cable route was 6,775 m.

REFERENCES

[1] T. Worzyk, "New book on submarine power cables, their design, manufacturing and installation." Springer, London and New York, 2009.

[2] IHO, *Manual on Hydrography*, 1st ed., no. May. MONACO, 2005.

[3] X. Lurton, *An Introduction to Underwater Acoustic: Principles and Applications*. Perancis: Praxis Publishing, 2002.