

# Hydrographic Survey in Basic Design Stage of Immersed Tunnel Planning for the New Capital City of Indonesia

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**Key words:** Bridge surveying; Hydrography; Positioning; Hydrographic Survey; Bathymetric; Tidal Survey; Mean Sea Level; Immersed Tunnel

## SUMMARY

Indonesia, one of the world's biggest economic countries, is currently developing a new capital city to replace the current capital of Indonesia, Jakarta. The Immersed Tunnel being one of the advanced infrastructure technologies is applied in the development of the new Capital City. The Immersed Tunnel is an underwater tunnel that span 750 meters across the Sepaku River. This tunnel plays role for the road network infrastructure in the city. The design of Immersed Tunnel requires a large scale of topographic data with a high level of detail. To provide highly accurate planning data, Hutama Karya conducted a hydrographic survey using Multi-Beam and Single Beam Echosounder to obtain the underwater topographic in the location of Immersed Tunnel. The MBES Survey specification is refer to Order 1B with 100% bathymetric coverage. The SBES Survey is used to complement the MBES specifically in the branch with qualification of Order 1B. Furthermore, to complete the land topography data on the shore area, Hutama Karya used LiDAR Data from an airborne survey sourced from the Geospatial Information Agency with a scale of 1:1000.

The bathymetric survey controlled through Bench Mark (BM) coordinate point located in a jetty at the survey location. Horizontal BM coordinate is measured by observing GNSS for 6 hours that simultaneously record the data with others GNSS CORS Base (CPEN and CBAL CORS) from Geospatial Information Agency. All the three data are adjusted with network adjustment method to provide the accurate horizontal coordinate. Vertical elevation of BM coordinate is defined from tidal survey for 30 days, which resulted in mean sea level (MSL) and value of Chart Datum (CD) as the reference for bathymetric data. The vertical elevation of BM from tidal survey is 2.033 m. The vertical elevation of BM value also verified by measuring the BM elevation using Total Station referred to the nearest control point network from Geospatial Information Agency. The result of the vertical elevation BM value from Total Station is 2.056 m, that has 2.6 cm deviation from vertical elevation from MSL. The tidal survey in BM is calculated using British Admiralty. The output from

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this calculation is the harmonic constituents to analyse the Formzahl value, that resulted in 0.36. According to the Formzahl value, the type of tidal in the location is mixed tide of prevailing diurnal.

Furthermore, the result of MBES Data according to the depth TVU is classified to special order with 95% level of confidence. The process of merging LiDAR data with Bathymetri is carried out by referring to the same BM elevation value. Afterwards, adjust the LiDAR and Bathymetric data using a correlated BM point coordinate to obtain a connection between land and water topography. The output of this activity is to provide bathymetric chart, digital terrain model, and contour with the interval of 1m from bathymetric and lidar survey for basic design stage for immersed tunnel.

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