Bench Mark Measurement and Situation Detailed Mapping on Sembulang, Batam City

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Abstract: Mapping is an activity aimed at providing information about a region and presenting in the form of maps. Land fields are defined as the surface of the earth which is a restricted field unit. The field mapping is done by measuring the position of the boundary points of the land to get the certainty in the area of the Earth. Mapping activities on this study were conducted on a terrestrial and extra-terrestrial basis. This research was conducted in Sembulang, Galang Sub-district, Batam City to get information about the state of topography in the area. The survey activities included Benchmark (BM) measurement and situation details mapping. In this study the detailed measurements of the situation represented the measurement of the points that form polygons, the boundary points of the road, and the boundary points of the land area. This research was conducted so BM point coordinate, and topographic maps were obtained. The data collection and processing techniques of this research are conducted using observation methods to the field which are conducted on a terrestrial and extra-terrestrial basis. The measurement in this study resulted Benchmark point with X coordinate: 417552; Y: 93084.8; Z: 14.333. The Topographic map describes the object details of the situation resulting from this research are obtained objects like a coconut tree, Street & Bridge Detail, Borderline, Shore, Sea, Gazebo, Tree, and Power Pole, Fence, Parcel Boundary.

1 INTRODUCTION

Mapping is an activity aimed at providing information about a region and presenting in the form of maps (Wicaksono, 2016). The need for measuring and mapping the land field in Indonesia is still very high where there are still many areas of land that have not been mapped (Adi, 2017). Measurement and mapping of land field is a series of activities in the registration of land (Ramadhony, 2017). Land fields are defined as the surface of the earth which is a restricted field unit. The field mapping is done by measuring the position of the boundary points of the land to get the certainty in the location of the land in the surface of the Earth (Setiadi, 2013). Mapping land parcels can later have an impact on land use and needed for development purpose (Gustin & Roziqin, 2019; Roziqin, Gustin, & Syari, 2018). The method of positioning a point on the Earth surface can be distinguished into two parts, namely: The method of measuring both terrestrial and extra-terrestrial (Abidin, 2007). On the measurement by terrestrial means, use the ETS (Electronic Total Station) measuring device is now commonly used and as well as point-position measurements with an extra-terrestrial method using the GNSS receiver RTK (Setiadi, 2013).

The mapping activities on this research are conducted on a terrestrial and extra-terrestrial basis. This research was conducted in Sembulang, Galang Sub-district, Batam City to get information about the topography in the area. This survey included construction of Benchmark Point (BM) and measurement of the situation details. This research aims to construct BM points, and presenting topographic maps. These activities include measurement, data retrieval, and GNSS data processing for the BM points and processing of detailed situation data. It is hoped that this research activity can serve as a reference source that can support the local community.

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2 RESEARCH METHOD

2.1 Research Location

The research is conducted in Sembulang, Galang subdistrict, Batam City. The research area of the study was in the measuring area of Location 1 and Location 2. The research location can be seen in the Figure 1.

2.2 Tools and Materials

In measurement activities, of course, the supporting activities of measurement activities are used in the field. The tools used in this research include:

1. Software: Microsoft Office 2010, Micrsoft Excel 2010, Autocad Civil 3D 2018 Metric, Magnet Tools.
2. Hardware: Statif, GR-5 GNSS Geodetic, Monopole, Electronic Total Station (ETS), tape measure, and Prism Detail.

2.3 Tools and Materials

The data collection and processing techniques of this research are conducted using observation methods at the field. Surveys in this study were conducted with the intention to BM points measurement and gather information about the topographical state of the situation. The flow of research carried out is shown in Figure 2.

The study was included in a descriptive research category using a survey method intended to collect information relating to the research conducted. The survey method of research conducted consists of Benchmark measurement using GNSS Static Method and Situation detailed measurement data collection using Electronic Total Station. In this study the detailed measurements of the situation were not all measured in full, but will be represented by the measurement of the field boundary points consisting of: the points that form the polygons, the boundary points of the road, and the points of field boundaries land.

Figure 1: Research Location.

Field data measurement is done by measuring start of the polygon point position by GNSS RTK and ETS on every road, polygon points, and land area. At GNSS RTK measurements must have a minimum of 2 receivers, one receiver is used as the Base (receiver station) and the second receiver is used for the Rover. with GNSS measurements higher position accuracy can be obtained such as Determination and Measurement of Horizontal Control Points study (Gustin, Roziqin, & Fatulloh, 2018). The research results are focused on giving an overview of the actual state on the object of interest.

The Measurement of BM point in this research required the stage of site survey and control point network before performing the observation and retrieval of data. The creation of topographical map requires detailed data of the situation in XYZ, in the detailed processing of the situation, in the need of the elevation correction phase of each detail of the situation based on the value of Mean Sea Level (MSL) through transfer of the palm elevation of the beach to the main. The detailed elevation correction of the situation can be seen in Table 1.

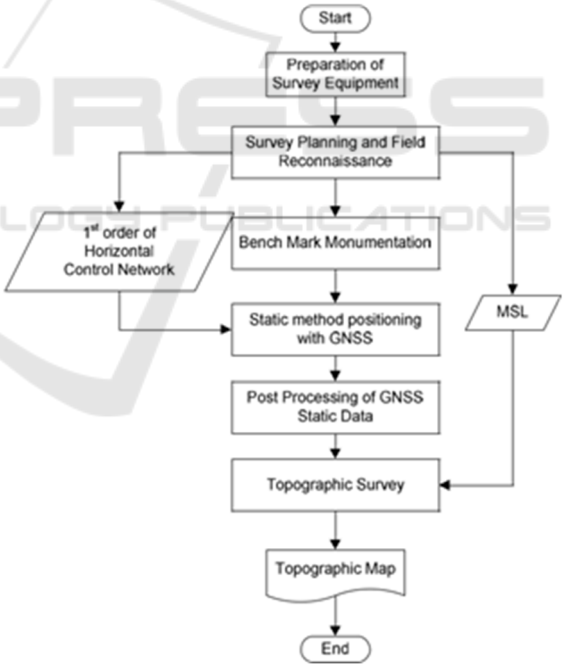

Figure 2: Research flow chart.

Table 1: Phase elevation correction formula.

No	Elevation Correction Stage	Formula
1	BM Elevation by MSL	ZBM(*msl*) = ΔH (Tidal Palm to BM) – *msl*
2	Corrected elevation of Connective point in the research area	A = ZBM(*msl*) + ∑ΔH previous point
3	Corrected elevation the connective point in the study area	Pt(1).kor = A + ΔH Pt(1) to A Pt(2).kor = Pt(1) + ΔH Pt(2) to 1 Pt(n).kor = Pt(n-1) + ΔH Pt(n) to n
4	Corrected Detail Object Elevation	O.kor = (Pt – O) + A.kor

Information

1. Δ H : The high difference in the elevation transfer from Palem Pasut-BM
2. MSL : Average-surface of the sea water
3. ZBM (MSL): BM elevation by MSL
4. A : Corrected elevation of Connective point in the research area
5. Pt (N). Kor : Corrected elevation of the connective point in the study area
6. Pt : Elevation of Connective point of study area
7. O : Detail Object elevation
8. O. Kor :Corrected Detail Object elevation.

3 RESULT AND DISCUSSION

3.1 Benchmark Point Measurement and Determining the Boundaries of the Research Area

Measurement of Benchmark Point on this research is done by GNSS observation static method for 8 hours with the network model that is between Politeknik Negeri Batam to Sembulang, Sembulang against Politeknik Negeri Batam, and Politeknik Negeri Batam to Hang Airport Nadim. The result of 8 hours of observation resulted in Benchmark point coordinates in the form of X, Y, Z used as a main point in Sembulang village. Benchmark Point coordinates can be seen in Table 2. The research site is divided into 5 areas of study. The determination of the area boundaries of research studies is conducted using the RTK method, the result of determining the region boundary using the RTK can be seen in Table 2.

Table 2: Benchmark coordinates and region boundary coordinates.

Point	E	N	Z
Benchmark	417,552	93,084.8	14.333
B11	417,577.729	93,326.744	13.99
B12	417,611.287	93,370.918	12.638
B14	417,639.154	93,391.808	12.141
B15	417,605.65	93,430.167	12.105
B16	417,634.933	93,483.443	14.82
BT1/T3	417,758.057	93,649.061	13.48
BT2/T2	417,695.305	93,459.678	12.897

3.2 Topography Maps

The result of the situation detailed mapping with the Figure 3. Topographic Map of Location 11:655 scale and the 1: 555 scale with a contour interval 0.5 meters for the measurement area of Group 4 and Group 2, the representation of the topographical map using AutoCAD Civil 2018. Topographic map of Location 1 measurement area and Location 2 in Figure 3 and Figure 4.

Figure 3 and Figure 4 described detailed measurements of the situation resulting from this research are obtained objects like a coconut tree, Bridge, borderline, Shore, Sea, Gazebo, Street, Tree, and Power Pole.

4 CONCLUSIONS

Based on the objectives and results of the study, it can be concluded that:

1. the data collection and processing techniques of this research are conducted using observation methods to the field which are conducted on a terrestrial and extra-terrestrial basis.
2. the measurement in this study resulted Benchmark point with X coordinate: 417552; Y: 93084.8; Z: 14.333.
3. the Topographic map describes the object details of the situation resulting from this research are obtained objects like a coconut tree, Street & Bridge Detail, Borderline, Shore, Sea, Gazebo, Tree, and Power Pole, Fence, Parcel Boundary.

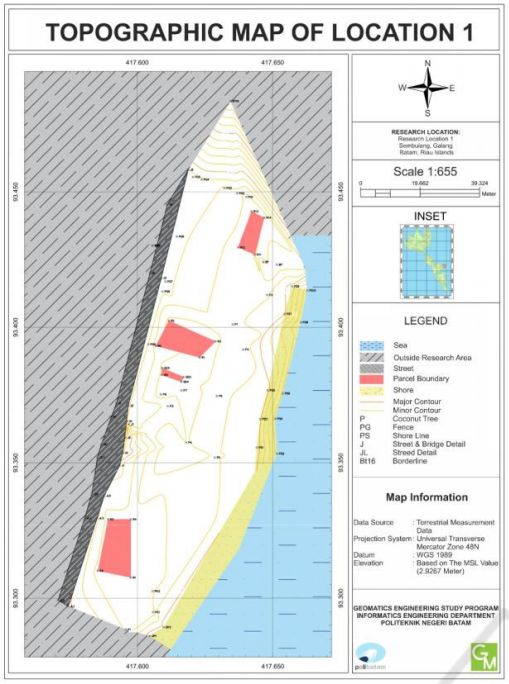

Figure 3: Topographic map of location 1.

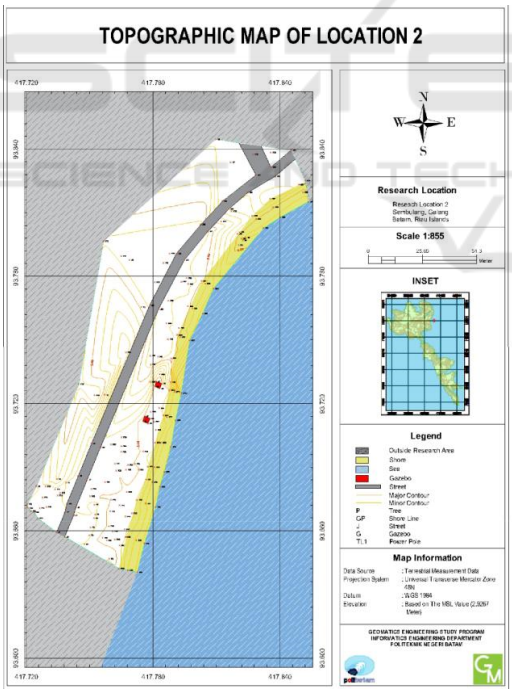

Figure 4: Topographic map of location 2.

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