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Evaluation of the Existing Conditions of Tinobu Port, Lasolo District, North Konawe Regency, Southeast Sulawesi Province

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ABSTRACT

The research location is located in Tinobu Village, Lasolo District, North Konawe Regency, which is a developing area and is known for its abundant natural wealth. Tinobu Port existed before Indonesia's independence, where Tinobu Port is tens of years old and has become an icon on the coast of North Konawe Regency, especially in Tinobu Village. Tinobu Port does not have any main facilities or supporting facilities that can facilitate activities at the port. Tinobu Port is widely used by local fishermen for loading and unloading of fish to be sold around the North Konawe Regency area and some are even sold as far as the city of Kendari. development after development has been carried out by the surrounding community as well as assistance from the local government so that at this time Tinobu Port already has a causeway with a length of approximately 400 (four hundred) meters, but due to the age factor, the condition of the causeway has also suffered a lot of damage. The purpose of this study was to evaluate the Existing Conditions of Tinobu Port, Lasolo District, North Konawe Regency in the form of several surveys conducted directly at the research location for future development purposes.

Keywords: tinobu port; existing conditions; field survey; North Konawe.

INTRODUCTION

Indonesia is a country that has quite extensive oceans. Its position is quite strategic, located in the equatorial region between two oceans, the Indian and Pacific Oceans, and two continents, Asia and Australia. The Indonesian sea, which was originally (Wawasan Nusantara version) an area of ± 3,166,000 km2, has become ± 6 million km2 according to the EEZ version, while the area of all seas on earth is ± 361 million km2. Coastal waters including beaches and estuaries (river estuaries) are most widely used by the community (Chen & Mao, 2018). The commitment of the Joko Widodo-Jusuf Kalla government to encourage Indonesia to become the world's maritime axis gives hope for improvements in the quantity and quality of ports. Ports are an important node for building strong maritime territories. Ports act as a catalyst to stimulate the growth of economic sectors, such as industry, trade, and tourism (Adam & Dwiastuti, 2015). As the largest archipelagic country in the world, Indonesia needs a port sector that is well-developed and managed efficiently. The competitiveness of producers in both national and international markets, internal distribution efficiency, and more generally, the cohesion and integrity of the national economy are greatly influenced by the performance of the port sector (Desiani, n.d.). Transportation development is directed at bridging gaps between regions and encouraging equal distribution of development results. Sea transportation plays an important role in the smooth running of trade because it has high economic value, including large carrying capacity and relatively low costs. To support trade and cargo traffic, ports were created as nodal points for the movement of goods where ships can dock, dock, load, and unload goods and forward them to other areas (Putra & Djalante, 2016a). In planning or building a port, several studies are carried out until the port can be built. The first study carried out for the construction of a port is a feasibility study. In this feasibility study, usually, the port location will consist of more than 1 (one)) study location which is then scored and determine which locations are suitable for building a port. Then the next study is the Port Master Plan (RIP), in this RIP study field surveys, are carried out again and data processing from the port locations that have been selected in the feasibility study, and in this RIP study stage more types of surveys are carried

out and are more specific than the feasibility study, and the last one is the Detail Engineering Design (DED) study, as the name suggests, at this study stage a detailed engineering design has been carried out regarding the model and function of the port to be built, in other words, this stage is the stage of making working drawings for the physical implementation of the development Port after the tender process is carried out (Gema Teknik Consultant, 2020). Tinobu Port is a people's port that has been used long before Indonesian independence occurred, development after development has been carried out by the surrounding community as well as assistance from the local government, until now Tinobu Port has a causeway with a length of approximately 400 (four hundred) meters and currently This is used as a base for fishing boats around and outside Lasolo District. The construction of Tinobu Port, Lasolo District, which is located in North Konawe Regency, Southeast Sulawesi Province, is a very special thing for the surrounding community. With the existence of this port, the standard of living and economy of the community can increase, and access to transportation and the procurement of goods and services will be easier, because the District Lasolo or more precisely Tinobu Village is a very strategic gateway for North Konawe Regency, the position of Tinobu Village (the location for the construction of Tinobu Port) is in the middle sector of North Konawe Regency, so it will be very easy to distribute goods that will enter Tinobu Port later (Primatama Prima Konsultama, 2021)

RESEARCH METHODS

The research location is located in Tinobu Village, Lasolo District, North Konawe Regency, which is a developing area and is very rich in natural resources that require transportation facilities to distribute agricultural products. Geographically, Lasolo District is located in the North of North Konawe Regency, stretching from North to South between 02097' and 03086' South latitude, stretching from West to East between 121049' and 122049' East longitude. The research location area was chosen deliberately in a location that has great potential for natural resources and requires port development so it is necessary to evaluate the existing condition of the port. Based on research material, this research will take place from October 2022 to February 2023 for approximately 4 (four) months with the scope of activities starting from the preparation, mobilization, pre-survey coordination, field survey implementation, and data analysis stages.

Research focus

This section will explain the research methodology used in this research. The type of approach used in this research is a deductive approach. Where the Deductive Approach is an approach process that starts from general circumstances and then draws specific conclusions (Busrah, 2012). According to Galo 2002 in (and Putri, 2020) a deductive approach is carried out by looking at existing theories and then making observations at the research location. This research is classified as non-experimental research because the data studied was not created intentionally and already exists and is composed of previous theories. (Arikunto, 2006). Meanwhile, the method used is mixed, namely qualitative and quantitative research. According to (Sugiyono, 2013) qualitative data is data in the form of words, sentences, and images, while quantitative data is data in numerical form (numbers) and the final result is data analysis from the existing Tinobu Port condominium.

Survey tools used

By the equipment used in field research, it is divided into 3 (three) types of survey equipment, namely tools used in topographic surveys, bathymetric surveys and tidal surveys, which can be seen in the table below.

Table 1. Names and Functions of Tools Used in Topographic Surveys

No	Tool's name	Survey Type	Tool Function
1	Total Station GM55 series	Topographic Surv	To take XYZ coordinates on land

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No	Tool's name	Survey Type	Tool Function
2	Stative		To support the Total Station equipment
3	Compass		To determine the north direction in topographic measurements
4	Pole		To support the prism
5	Prism		To reflect the laser beam from the Total Station tool/to determine the coordinates
6	Roll Meter 50 meters		To measure a maximum distance of 50 meters
7	Roll Meter 5 meters		To measure the height of the measuring instrument
8	Camera		To take pictures
9	Garmin Hand GPS		To determine local coordinates
10	Umbrella		To protect the Total Station equipment from rain and sunlight
11	Nail		To mark the point where the Total Station tool will move
12	Drones		To take pictures of the situation from the air
13	ATK		To take notes that are necessary during the survey

Table 2. Names and functions of tools used in bathymetric surveys

No	Tool's name	Survey Type	Tool Function
1	GPS Maps 585 Plus	Bathymetric Survey	To take the XY coordinate point in the water
2	Transducer		To take the Z coordinate point in the water
3	Garmin Antenna		To help the GPS Maps 585 Plus tool in determining coordinate points
4	Boat		To carry measuring instruments and surveyors across the sounding routes that have been created
5	MMC type memory card		To copy data from the GPS Maps 585 Plus tool to a computer and process the data
6	Rope/Duct Tape		For strapping Garmin and Transducer antennas on boats
7	Lifebuoy		For use in times of emergency
8	Camera		To take pictures
9	ATK		To take notes that are necessary during the survey

Table 3. Names and Functions of Tools used in Tidal Surveys

No	Tool's name	Survey Type	Tool Function
1	Measuring Signs / Reading Scale Bars	Tidal Survey	To read the tides / rise and fall of sea water levels during the Survey
2	Rope/Duct Tape		For strapping Garmin and Transducer antennas on boats

3	Lifebuoy	For use in times of emergency
4	Camera	To take pictures
5	ATK	To take notes that are necessary during the survey

Data collection

The method used by the author in collecting data is by collecting primary data directly at the study location at Tinobu Harbor. Primary data collection took the form of carrying out several field surveys including topographic, bathymetric, and tidal surveys. These surveys were carried out by the author and assisted by several friends, this is because several surveys must be carried out simultaneously, such as bathymetric surveys must be carried out simultaneously with tidal surveys every 15 minutes during the bathymetric survey, and topographic surveys must also be carried out on when a temporary bathymetric survey is taking place to obtain elevation ties between land and sea.

In this research, the data obtained was mostly carried out directly in the field which is primary data, and was obtained from related agency offices such as BMKG which is secondary data. The following is some data collection that has been carried out by the author at the study location:

Topographic Survey

The topographic survey was carried out by the author using a Topcon GM55 series total station tool. This survey aims to obtain an overview of the shape of the land surface in the form of the situation and height and position of features in the research location area and the surrounding area. Topographic surveys map the area, position, and elevation of land relative to tides for accurate land improvement and leveling volumes. The Survey Area extends parallel to the coastline. The results are then mapped with a certain scale and contour interval. The method used is terrestrial, land elevation to the lowest water level, and its position to global coordinates.

Bathymetric Survey

Bathymetric surveys are carried out to determine the depth of the seabed relative to the water surface. Bathymetric surveys are very important to determine the depth required based on the planned specifications for the largest ship that will dock at a port. The depth of the water (seabed) will be tied to the land elevation which is the result of a topographic survey and then a contour will be made connecting the land elevation and water elevation. The measurement process uses a single beam bathymetry tool type GPS Maps 585 Plus, with the help of a fishing boat the sounding process is carried out around the waters of Tinobu Port.

Tidal Survey

Tidal conditions in the study area will greatly influence the characteristics of waves, currents, and planned sea level heights which will then determine the stability analysis of coastal structures and determination of their peak elevations. In this regard, the author has conducted a study and analysis of tidal data in the waters of Tinobu Harbor. This study and analysis is based on tidal data at the location. Ocean tides are the rise and fall of sea levels that occur periodically due to the gravitational influence of celestial bodies, especially the moon and sun. Tidal observations aim to obtain sea level height tied to a vertical datum or certain elevation reference plane, by taking sea level height data for a predetermined period. The simplest tidal observations are carried out using measuring poles which are usually called palms (peil schaal), with an observation time interval of one hour, and carried out for 15 (fifteen) days. The choice of location for installing the peil Schaal is conditioned in such a way that when the position is low, the palm tree remains in a submerged condition.

Data Analysis

The data in this research is processed and analyzed using a computerized system, this is done to make data analysis easier and reduce human error. The applications used in this research are Microsoft Office 2019, Autocad Land Desktop 2009, Autocad 2012, Autocad Civil 3D 2015, Maps Sources, Basecamp, Google Earth, Sokkia Link, Topcon Link, and several other supporting applications. All primary and secondary data that has been collected by the author at the study

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location will be processed and analyzed in the next chapter. Researchers will create an innovative design for the future development plan for Tinobu Port. The research area used by researchers to collect data is in the water and land areas around the location of Tinobu Port. The final output that will be created by researchers is to create an innovative design plan for the development of Tinobu Port both from the land and waterside in the form of a master plan layout image for Tinobu Port.

RESULT AND DISCUSSION

Existing Condition of Tinobu Port

Tinobu Port is located in Lasolo District, North Konawe Regency, where Tinobu Harbor is the only port in Lasolo District. Lasolo District has an area of 139.40 km2 and has a population of 8,129 people, divided into 4,168 men and 3,961 women, where the population of Lasolo District is the largest of the 13 Districts in North Konawe Regency. From the past until now Tinobu Harbor has been used as a fish landing place for local fishermen, currently, there are around 6 to 8 fishing boats that occupy Tinobu Harbor, some of the fish produced by fishermen are sold directly to collectors, some are sold directly to the market, and some are sent out of Lasolo District and even out of North Konawe Regency (source: results of direct observations and interviews with people in the field).

Figure 1. The existing condition of Tinobu Port Field Survey Data

Bathymetry

The bathymetric survey is a mapping survey to determine the topography of the bottom of the waters using a sounding method using sound waves with a measuring instrument in the form of an Echosounder. The horizontal positioning system used at sea is a satellite-based positioning system using the Real Time Kinematic Differential Positioning method using a previously created base or reference point (BM).

Figure 2. Bathymetric Survey Implementation Process

Survey Results

Based on tidal observations every 15 minutes during sounding, the observation results can be seen in Table 5.

Table 4. Tidal Observations During Bathymetric Surveys

No.	Observation Date and Time		Water Level Elevation (cm)		
			High	Low	Average
1	21-Nov-22	10:45:00	240.0	240.0	240.0
2	21-Nov-22	11:00:00	241.0	233.0	237.0
3	21-Nov-22	11:15:00	241.0	229.0	235.0
4	21-Nov-22	11:30:00	244.0	226.0	235.0
5	21-Nov-22	11:45:00	241.0	224.0	232.5
6	21-Nov-22	12:00:00	240.0	222.0	231.0
7	21-Nov-22	12:15:00	238.0	220.0	229.0
8	21-Nov-22	12:30:00	230.0	218.0	224.0
9	21-Nov-22	12:45:00	227.0	214.0	220.5
10	21-Nov-22	13:00:00	224.0	209.0	216.5
11	21-Nov-22	13:15:00	220.0	195.0	207.5
12	21-Nov-22	13:30:00	210.0	191.0	200.5
13	21-Nov-22	13:45:00	205.0	187.0	196.0
14	21-Nov-22	14:00:00	196.0	176.0	186.0
15	21-Nov-22	14:15:00	184.0	168.0	176.0
16	21-Nov-22	14:30:00	176.0	93.5	134.8

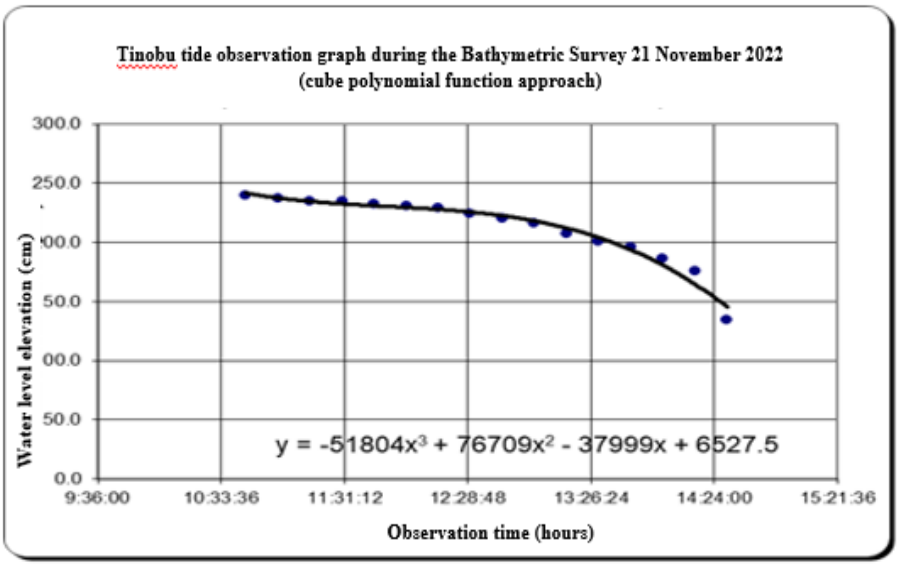

Figure 3. Tidal Observation Graph During Bathymetric Survey

Table 5. Seabed Elevation Calculation Results

No.	Measurement Time x (Hours)	Water Level Elevation y (m)	z (m)	z + h (m)	correction (kr) (m)	z_{kr} (m)
1	10:45:00	0.785	0.8	0.9	0.267	0.633
2	10:45:10	0.786	1.4	1.55	0.268	1.282
3	10:47:30	0.799	3.0	3.15	0.281	2.869
4	10:47:35	0.799	3.0	3.15	0.281	2.869
5	10:47:40	0.800	3.2	3.35	0.282	3.068

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No.	Measurement Time x (Hours)	Water Level Elevation y (m)	z (m)	z + h (m)	correction (kr) (m)	z_{kr} (m)
6	10:47:45	0.800	3.4	3.55	0.282	3.268
7	10:47:55	0.801	4.2	4.35	0.283	4.067
8	10:48:00	0.802	4.6	4.75	0.284	4.466
9	10:48:05	0.802	4.7	4.85	0.284	4.566
10	10:48:10	0.802	5.3	5.45	0.284	5.166
11	10:48:15	0.803	5.5	5.65	0.285	5.365
12	10:48:20	0.803	5.5	5.65	0.285	5.365
13	10:48:25	0.804	5.7	5.85	0.286	5.564
14	10:48:30	0.804	5.8	5.95	0.286	5.664
15	10:48:35	0.805	5.4	5.55	0.287	5.263

etc……!!

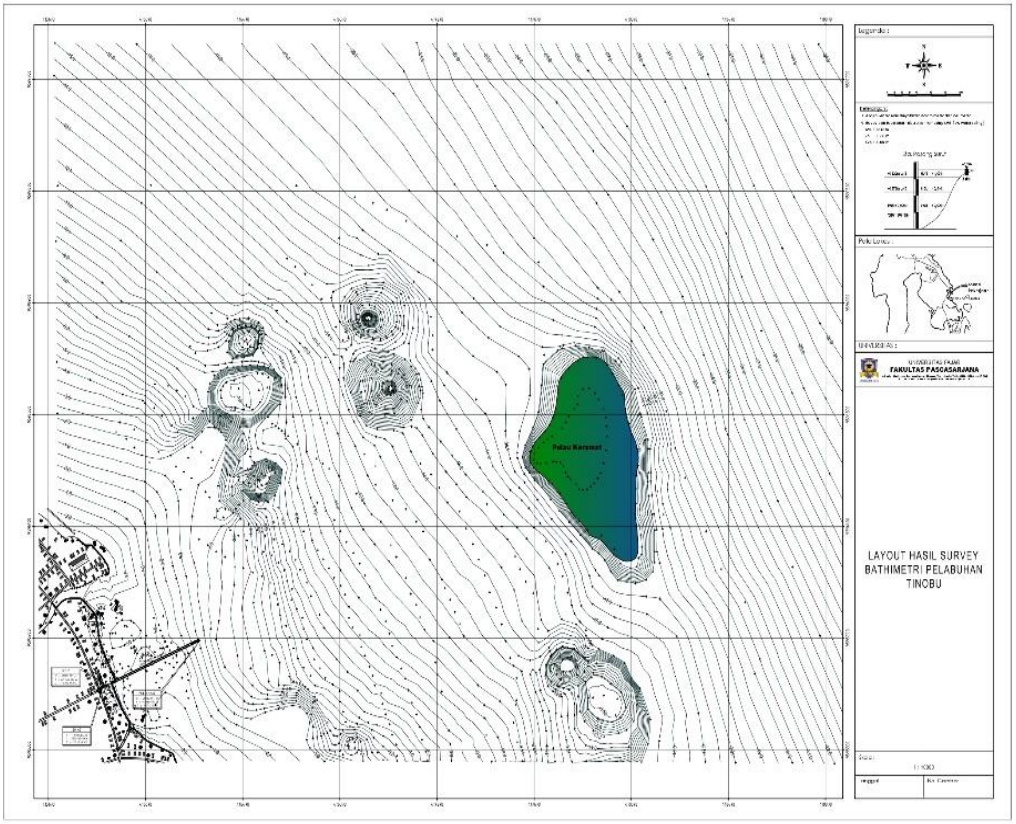

Figure 4. Layout map of bathymetric survey results at Tinobu Harbor

Topography

Topography is the study of land surfaces. This term can also refer to the high and low conditions of the land surface, so that in particular it can be said that topography lays the foundation that underlies the landscape. For example, topography refers to mountains, valleys, rivers or parts of land at a port.

Figure 5. Topographic Survey Implementation Process

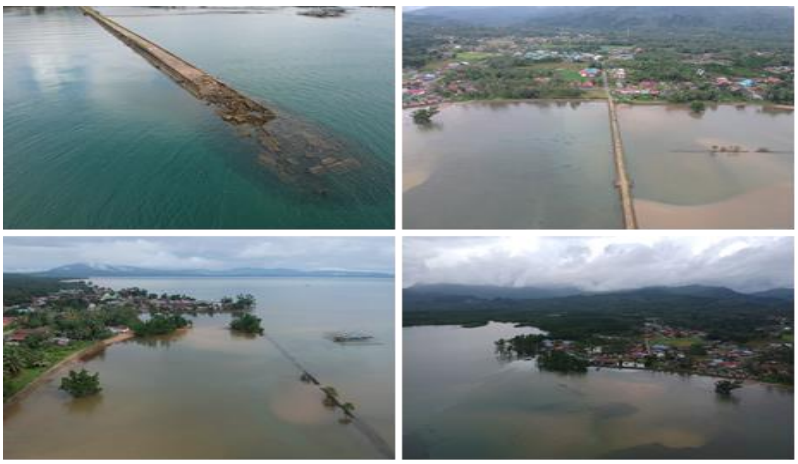

Figure 6. Tinobu Port Aerial Documentation

Survey Results

A topographic Survey is a survey carried out to determine the condition or contour of a plot of land on land. Topographic measurements were carried out at Tinobu Harbor using a Total Station type Topcon GM55 series. Where the output of this tool is digital data which can be directly copied to a flash disk and processed on a computer using the Autocad application. Data from topographic measurements at Tinobu Harbor can be seen in Table 6.

Table 6. Topographic Measurement Data for Tinobu Harbor

Point (P)	North (Y)	East (X)	Elevation (Z)	Code (CD)	Information
1	9595680.5518	416266.9704	2.8700	STN	*Topo*
2	9595690.7888	416302.6404	-0.2730	ACPeilschaal	*Topo*
3	9595690.7888	416302.6394	-0.2730	ACPeilschaal	*Topo*
4	9595678.0108	416269.9954	3.0730	DC	*Topo*
5	9595678.1298	416269.8354	3.0660	DC	*Topo*
6	9595682.1838	416269.2324	3.0880	DC	*Topo*
7	9595682.3128	416269.0024	3.0930	DC	*Topo*
8	9595682.4678	416268.6594	2.7810	DC	*Topo*
9	9595680.1988	416268.3054	2.8760	CD	*Topo*
10	9595678.8908	416266.2424	2.8520	CD	*Topo*

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Point (P)	North (Y)	East (X)	Elevation (Z)	Code (CD)	Information
11	9595678.9078	416260.3034	2.8080	CD	*Topo*
12	9595679.1598	416261.5624	3.1200	CD	*Topo*
13	9595678.9368	416261.5584	3.1050	CD	*Topo*
14	9595675.6038	416263.9074	3.0850	CD	*Topo*
15	9595675.5208	416264.1464	3.0970	CD	*Topo*

etc……!!

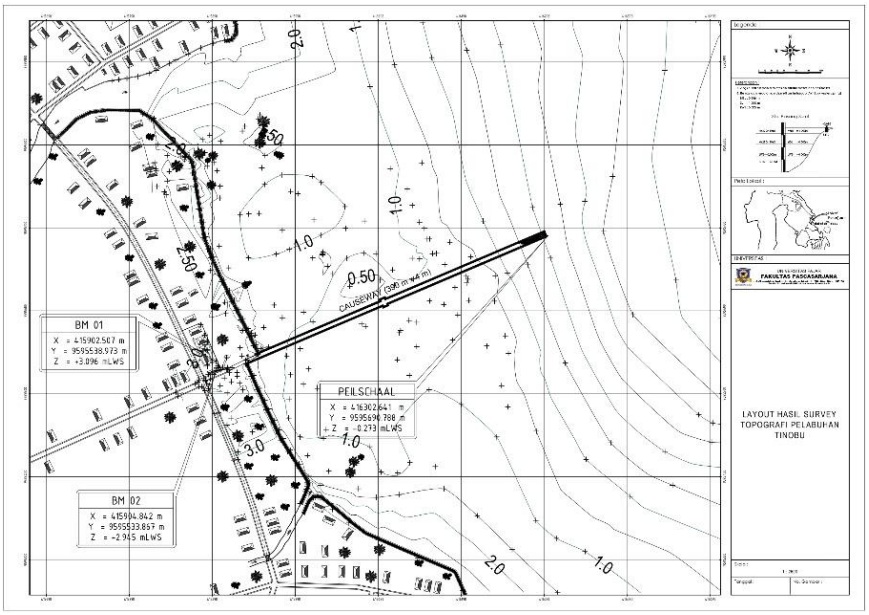

Figure 7. Layout Map of Tinobu Harbor Topographic Survey Results

Ups and down

Tides are fluctuations in sea level due to the gravitational force of objects in the sky, especially the sun and moon, on seawater masses. A tidal height is the vertical distance between the highest water and the lowest water respectively. The tidal period is the time required from the water level position at the average water level to the next same position. Variations in sea level give rise to currents called tidal currents, which transport very large masses of water.

Figure 8. Process of Implementing Tidal Surveys

No.	Tanggal	Bacaan Skala pada jam																								Jumlah Bacaan	Bacaan rata^2/hari
		00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23		
1	22 Oktober 2022	221	212	203	194	185	176	167	158	170	173	192	224	227	238	223	192	163	113	84	58	69	97	133	175	4043.00	168.46
2	23 Oktober 2022	201	232	241	235	216	194	160	146	131	153	172	219	226	248	238	225	194	156	109	78	70	82	108	146	4178.50	174.10
3	24 Oktober 2022	169	218	238	248	235	196	173	150	127	122	130	172	201	230	245	240	218	182	151	97	88	83	115	126	4153.50	173.06
4	25 Oktober 2022	165	179	190	247	263	240	188	168	123	117	126	147	166	189	236	246	227	204	188	178	82	93	98	117	4176.50	174.02
5	26 Oktober 2022	154	192	198	207	216	220	206	196	187	179	103	118	130	138	147	156	166	155	146	142	112	108	114	128	3818.00	159.08
6	27 Oktober 2022	139	148	156	169	177	199	188	176	118	120	106	100	156	169	181	187	199	219	226	208	98	109	115	132	3794.50	158.10
7	28 Oktober 2022	148	156	166	176	187	178	178	169	159	147	138	128	122	126	139	130	140	149	156	161	169	156	148	138	3664.00	152.67
8	29 Oktober 2022	126	136	147	160	166	176	187	166	157	148	137	110	96	102	109	116	124	130	140	137	138	127	121	115	3271.00	136.29
9	30 Oktober 2022	116	123	128	136	144	152	160	166	157	146	136	127	117	108	157	167	179	187	197	189	187	177	167	159	3682.00	153.42
10	31 Oktober 2022	146	140	131	139	150	157	160	164	166	157	152	138	126	117	129	137	147	162	171	167	182	192	187	176	3693.00	153.88
11	1 November 2022	167	173	177	182	169	191	187	177	169	157	147	138	126	121	117	125	132	142	151	156	165	171	179	187	3806.00	158.58
12	2 November 2022	177	167	163	149	157	152	136	144	153	158	166	159	147	137	127	119	107	113	119	125	130	139	145	151	3440.00	143.33
13	3 November 2022	187	183	171	159	147	143	149	157	169	176	184	179	170	161	151	136	127	116	127	136	147	156	167	176	3774.00	157.25
14	4 November 2022	197	186	177	147	153	165	167	179	191	178	171	157	165	151	145	133	121	111	101	157	170	179	187	197	3885.00	161.88
15	5 November 2022	206	197	186	179	188	194	176	168	181	186	197	206	218	214	183	168	117	113	107	112	117	123	130	140	4006.00	166.92

Figure 9. Results of Tide Observations for 15 Days in Tinobu Waters

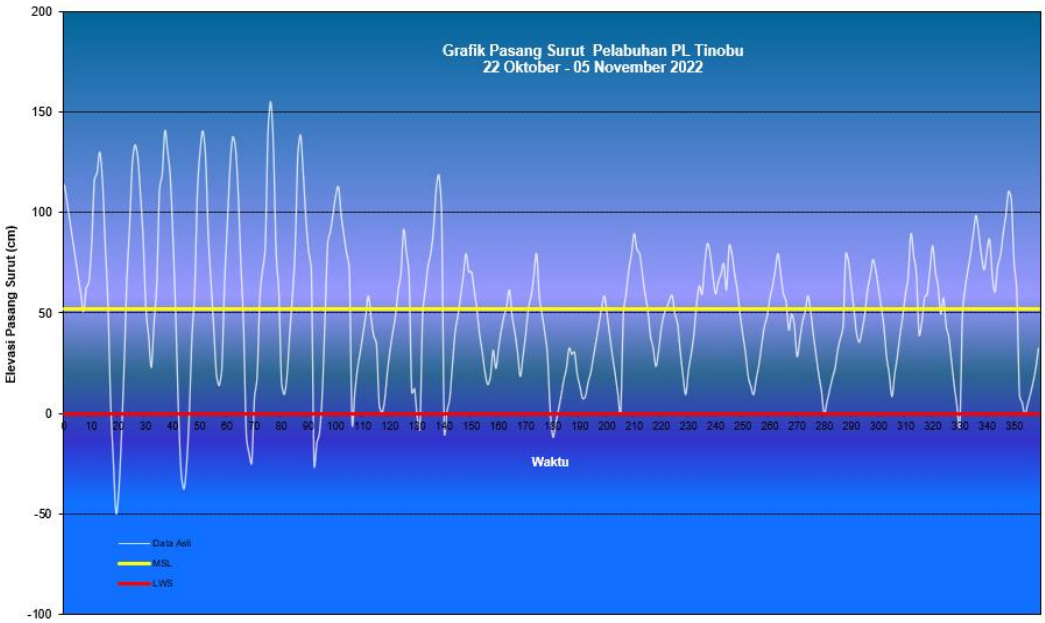

Figure 10. Graph of Tide Calculation Results for 15 Days at Tinobu Port

CONCLUSION

Based on the results of the field survey and data analysis carried out in this research, it can be concluded that: (1) the water condition of Tinobu Harbor through a bathymetric survey has an average depth of 5-10 meters at a coastline distance of 100 meters. With this depth data, Tinobu Harbor has the opportunity for future port development. (2) the land condition of Tinobu Port through a topographic survey shows that the land is sloping, so it has great potential for the development of a port land area. (3) the condition of the tidal cycle around Tinobu Harbor through a tidal survey which was carried out for 15 days at the research location, shows that the average water level during the tidal cycle is at 0.50 meters so that this area is safe to build a port. Apart from that, at the Tinobu Harbor location there is a tidal cycle with an intensity of two highs and two lows within 1 x 24 hours.

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