Technical Feasibility Analysis of Waode Buri-Lelamo Port as Local Feeder Port in North Buton Regency Southeast Sulawesi Province

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Abstract. Wa Ode Buri-Lelamo Port is located in North Kulisu District, North Buton Regency, Southeast Sulawesi Province, Indonesia. This study can be information about the prospect of developing Lelamo Port, so that it can support economic acceleration in the islands of Southeast Sulawesi Province. This study is aimed at increasing the port of Lelamo to become a local feeder port. Local ports are adjusted to eligibility standards. This feasibility standard is based on the regulation of the Minister of Sea Transportation, No. PM 146, 2016. Data obtained by observation and literature. Data related to port planning. Data is analyzed in a quantitative way. Data is given scoring against eligibility requirements. Technical feasibility requirements include land topog, bathymetry and hydro oceanography. The results of this study concluded that the Waode Buri-Lelamo port is considered feasible to be a local feeder port. This study recommends that the port needs to be made trestell with a size of 6 m x 22 m, a pier made with a size of 8 m x 70 m, and the lowest apron height of 5 m from tides.

1. Introduction
Waode Buri-Lelamo Port is located in North Kulisu District, North Buton Regency, Southeast Sulawesi Province, Indonesia. This port is 10 km from the city. This port is the gateway to North Buton. This port has problems, as follows: 1) port support facilities are inadequate; 2) minimal port infrastructure components, such as parking, waiting rooms and causeways; 3) this port only serves small-scale vessels (2500 GRT). Buri-Lelamo Port is designated as a local feeder port [1]. This Ministerial Decree concerns the National Port Master Plan for the Waode Buri-Lelamo port. Thus, this port needs to be upgraded to the study of local feeder port facilities. This study analyzes the value of the technical feasibility of the port area (facilities, infrastructure, and marine areas) against the local feeder port standard. This study is important to do, as follows: 1) this study is a reference for local feeder ports in the archipelago; 2) this study can be a reference for economic development in the island and coastal regions. This study is aimed at increasing the port of Lelamo to become a local feeder port. Local ports are adjusted to eligibility standards. This feasibility standard is based on the regulation of the Minister of Sea Transportation, No. PM 146, 2016.
2. Literature Review

The aspects of the technical feasibility of the port are discussed, as follows: 1) the type and characteristics of the ship adapted to the minimum standards of local passenger ports; 2) port facilities adapted to the minimum local port standards, such as ship circulation, port loading and unloading, and passenger circulation.

2.1. Ship Principal Size

If the ship's plan is unknown, the pier length is rounded up. The length of the ship is 5 meters. The depth of the pier pool is rounded up. The pier pool is obtained with 0.5 meters and is calculated by LLWL elevation (Table. 1).

| DWT (t) | GT (t) | Dock length (m) | Depth of Pier (m) | Apron width (m) |
|---------|--------|-----------------|-------------------|-----------------|
| 350     | 445    | 60              | 5                 | 15              |
| 500     | 745    | 65              | 5                 | 15              |
| 750     | 980    | 75              | 5                 | 15              |
| 1000    | 1200   | 80              | 5                 | 15              |

2.2. Ship Flow and Wave Height in Port Pool

The area of the swivel pool is used to change the direction of the minimum vessel. The area of the swivel pool is obtained by means of a circle radius 1.5 multiplied by the total length of the vessel. The length of the ship used the length of the largest ship. The area of the minimum swivel pool is obtained by means of the circle radius equal to the total length of the vessel (Loa). The minimum swivel pool area is required with the help of anchors and tugs. The depth of the pond is obtained by 1.1 x draft of the ship. The terms of the ship's draft are fully charged and below the water level. The cruise lay out is in a straight line and the current is opposite to the direction of the ship. The turn of the ship is in the shape of a curved curve. Critical wave height is required in the port pool of 0.3 m - 1.5 m.

2.3. Criteria for Local Feeder Ports

Local ports serve sea transportation activities and have a local scale. This is based on PP 61/2009 on Shipping and KM 53/2002 concerning the National Port Order. Local port criteria, as follows: 1) the local port acts as a feeder port; 2) the local port acts as a passenger service area; 3) the local port acts as a place for sea transportation services; 3) local ports are not traversed by regular sea transportation routes; 4) the local port has a minimum depth of -1.5 m LWS; 5) local ports have mooring facilities; 6) local ports have a distance of 5 - 20 miles; 7) the local port has a low loading and unloading volume <8,588,000; 6) the local port has a long distance classification (International / ALKI lines> 179 miles); 7) local ports have a classification of docks to the size of short ships <103 m; 8) the local port has a depth of <5 m.

3. Research Method

Port feasibility analysis is carried out using Quantitative methods. The criteria of this study refer to KP 414 of 2013 [3]. KP 414 of 2013 is a master port plan for the sea and the Decree of the director general of sea transportation. This regulation is about technical guidelines and procedures for
construction of sea ports and has been modified. Building design at the port can reduce wave height [4]. The eligibility criteria are given scoring (Table 2), as follows:

**Table 2.** Indicator of Technical Feasibility Assessment (Source: KP 414 of 2013 concerning sea port master plan and Director General of Sea Transportation Decree. This regulation is about technical guidelines and procedures for the preparation of sea port development 2015 and has been modified).

| Criteria                  | Weight | Feasibility Indicator                                                                                                                                                                                                 | Value |
|---------------------------|--------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|
| Topography and Slope      | 25%    | • Topographic modeling has a low value and hilly contours of 100 - 500 Meters of MPA.                                                                                                                                     | 1     |
|                           |        | • Topographic modeling has a moderate value and quite hilly contour 0-100 meters DPL.                                                                                                                                     | 5     |
|                           |        | • Topographic modeling has a high and contour values obtained from 0-100 meters DPL.                                                                                                                                      | 10    |
| Bathymetry                | 50%    | • Bathymetry modeling has a low value. This is based on a minimum standard of depth of sea ports The local local port hierarchy is equated with local feeder ports. The hierarchy of local feeder ports is a value of -4 LWS or 4 m depth (RIPN 2013). | 10    |
|                           |        | • Bathymetry modeling has a moderate value. This is based on a minimum standard of depth of sea ports. The hierarchy of local feeder ports is a value of -4 LWS or 4 m depth (RIPN 2013). | 5     |
|                           |        | • Bathymetry modeling has a high value. This is based on a minimum standard of depth of sea ports. The Local Feeder Port hierarchy is obtained at a value of -4 LWS or 4 m depth (RIPN 2013). | 1     |
| Hydro - Oceanography      | 25%    | • Hydroconographic modeling has a low value. This is influenced by tides, monsoons, and high waves.                                                                                                                    | 10    |
|                           |        | • Hydroconographic modeling has a moderate value. This is influenced by tides, monsoons, and medium waves.                                                                                                                  | 5     |
|                           |        | • Hydro-oceanography modeling has a high value. This is influenced by tides, monsoons, and low waves.                                                                                                                     | 1     |
4. Result and Discussion

4.1. Port Area Location
The geographical position of the Waode Buri - Lelamo port, as follows: latitude 4°39'31,740s and longitude 123°11 ', 170e. This port is a distance of ± 10 km from the City Center. This port has facilities, such as waiting rooms, parking lots and causeways. This port has no trestel yet. This port can only be visited by public boats. Pioneer ships are still anchored outside the Port (Fig. 1).

![Figure 1. Port Area existing.](image)

4.2. Topography and Slope
Topographic analysis uses data and information. Data and information are obtained in the Regional Spatial Planning document, North-Southeast Buton District, 2014-2034. This document is completed with observations in the field.

The location of the Waode Buri port has a slope of 8-15% (hilly) and height at the port plan of ± 4 meters DPL (Table 3). The data processing results above are compared with indicators. Assessment indicators use topographic and slope technical aspects, as follows:

| Aspect                     | Weight | Assessment Indicator                                      | Value  |
|----------------------------|--------|----------------------------------------------------------|--------|
| Topography and slope       | 25%    | Topographic Modeling results have a high value and have a sloping value of 0-100 meters DPL | 10     |

4.3. Topography and Slope
Waode Buri Port is deeper than the standard. This is based on a minimum standard of depth of sea ports. The standard hierarchy of local feeder ports is a value of -4 LWS or a depth of 4 meters (RIPN 2013) (Table 4).

| Table 4. Bathimetry analysis of the port area based on coastline distance (Source: Results of Bathimetry FS Analysis, 2017). |
4.4. **Hydro Oceanography**

North Buton Regency has a flat coastline. The coastline ranges from 0-100 meters to the sea. Waode Buri Port is located inside the bay and has a depth of 22 m from the 50-meter coastline. The Port location is located ± 1350 m and leads to the open sea. Thus, the impact of wind and waves is eliminated by the shape of the bay.

4.5. **Tidal Data**

![Figure 2. Tidal FS Oceanographic Survey Results at Waode Buri Port (Source: Tidal Location Survey, 2017).](image)

4.6. **Sea Wave Data**

**Table 5.** Number and Frequency of Wave Events (Source: The results of the FS 2017 survey analysis).

| Arah    | Kecepatan Angin (m/det) | Kecepatan Angin (% dari) | Jumlah Frekuensi Kejadian Gelombang | Persentase Frekuensi Kejadian Gelombang (%) |
|---------|-------------------------|--------------------------|-------------------------------------|--------------------------------------------|
|         | < 0,1                   | 0,1-0,2                  | 0,2-0,3                             | 0,3-0,4                                    | > 0,4                                     |
| Utara   | 0,00                    | 0,00                     | 0,00                                | 0,00                                       | 0,00                                      |
| Timur   | 0,00                    | 0,00                     | 0,00                                | 0,00                                       | 0,00                                      |
| Laut    | 0,00                    | 0,00                     | 0,00                                | 0,00                                       | 0,00                                      |

![Table 5. Number and Frequency of Wave Events (Source: The results of the FS 2017 survey analysis).](image)
Wind speed is measured at the dock point. The results of wind speed measurements are as follows:
Most winds are between 1 - 11.5 m/sec (22 Knots) (Table 6).

**Table 6.** Oceanographic analysis of tides, wave height and wind speed in the sea port area (Source: Results of Tidal FS Analysis, 2017).

| Conditions                        | Assessment          | Value |
|-----------------------------------|---------------------|-------|
| Tidal Conditions:                 | The results of      | 10    |
| 0 - 0.5 meter                     | hydro-oceanographic |       |
| Wave Height: 0 - 1.5 Meter        | modeling have       |       |
| Wind velocity: 2 - 20 Kno         | high values         |       |

4.8. **The Width And Flow Of The Ship Turning On The Port Area**

The flow of the ship starts from the gate, the port area and the dock. The flow of the ship has a length of 1,310.54 meters. Groove width 01 = 137.15 m, groove width 02 = 220.10 m, and groove width 03 = 488.80 m. The flow of the ship is required with the flow of the local feeder port. The local feeder port has a groove width of at least 114 m (7 x Pl + 30 Length). The maximum ship rotation path is valued at R => 5 Loa (Figure 8 A). The boat rotation path = 220.10 m is the maximum value of R => 3 Loa (Figure 8 B). The distance of the ship's groove starts from the lighthouse gate to the Port = 1.310.54 M. The width of the swivel channel of this port vessel meets the feasibility standard.

5. **Conclusion**

This Based on the feasibility study above, the Waode Buri-Lelamo port is considered feasible to be a local feeder port. This study recommends that the port needs to be made trestell with a size of 6 m x 22 m, a pier made with a size of 8 m x 70 m, and the lowest apron height of 5 m from tides.

**References**

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