

**THE STUDY TO DETERMINE THE IDEAL BOLLARD PULL
CAPABILITIES OF TUGBOAT IN BINTULU PORT MALAYSIA**

LAU HOCK FAT

**FACULTY OF MARITIME STUDIES AND MARINE SCIENCE
UNIVERSITY OF MALAYSIA, TERENGGANU**

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CAPABILITIES OF TUGBOAT IN BINTULU PORT MALAYSIA**

By

LAU HOCK FAT

**Research Report submitted in partial fulfilment of
the requirement for the degree of
Bachelor of Science (Nautical Science and Maritime Transportation)**

**Department of Nautical Science & Maritime Transportation
Faculty of Maritime Studies & Marine Science
University of Malaysia, Terengganu**

2012



DEPARTMENT OF NAUTICAL SCIENCE AND MARITIME
TRANSPORTATION
FACULTY OF MARITIME STUDIES AND MARINE SCIENCE
UNIVERSITI MALAYSIA TERENGGANU

DECLARATION AND VERIFICATION REPORT

FINAL YEAR RESEARCH PROJECT

It is hereby declared and verified that this research report entitled:
The Study to Determine the Ideal Bollard Pull Capabilities of Tugboat in Bintulu Port Malaysia, by Lau Hock Fat, Student ID: UK 18108 has been examined and all errors identified have been corrected. This report is submitted to the Department of Nautical Science and Maritime Transportation as partial fulfilment towards obtaining the Degree of Bachelor of Science (Nautical Science and Maritime Transportation), Faculty of Maritime Studies and Marine Science, University of Malaysia, Terengganu (UMT).

Verified by:


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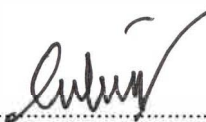
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DECLARATION

I hereby declare that the work in this thesis is my own except for quotations and summaries which have been duly acknowledged. I also declare that it has not been previously or currently submitted for any other degree in UMT or other institutions.

Signature : 

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ABSTRACT

THE STUDY TO DETERMINE THE IDEAL BOLLARD PULL CAPABILITIES OF TUGBOAT IN BINTULU PORT MALAYSIA

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Bintulu Port is well-known as a World Class LNG port, which strategically located along the busy sea trade between the Far East and Europe trade in North-east Coast Sarawak which located at 03 degree 16 minutes North and 113 degree 04 minute East (Bintulu Port Authority, 2011). Due to the increasing in size of vessels and the number of port calls, it is imperative to know and determine the ideal combined total bollard pull capabilities of tugboat needed in Bintulu Port in order to ensure safe and efficient ship handling operation. The study will also attempt to determine the most economic type of tugboat amongst the type used in Bintulu Port. The total bollard pull required to compensate internal and external force were calculated by using the formulae used in OCIMF publication. The data of the wind and wave data were obtained from Malaysian Meteorological Department, while the current force data within the port area was obtained from the Bintulu Port Authority. The data for tugboats particular, Monthly Boat Utilization Records, and towage charges were obtained from Bintulu Port's operator. The average operation time taken between the Tractor-tug (Voith-Schneider Propeller) and Azimuth Stern Drive tug (Schottel Rudder Propeller), the times are 1 hour 31 minutes and 1 hour 27 minutes respectively for LNG carrier departure handling operation. For LNG carrier arrival operation, average times taken are 2 hour and 25 minutes and 2 hour 22 minutes respectively. Therefore, there is no significant difference for the operation time between these two types of tugboat. Furthermore, due to the towage charges in Bintulu Port was calculated base on the "Block system", according to the bollard pull capacity of tugboat, the towage charges are similar for both types of tugboats on the similar type of operation. However, in-term fuel consumption between the two types to tugboat, Tractor tug has relatively better fuel-efficient and are economical to operate compared with ASD tug with the same bollard pull capacities. The Tractor tug consumes 300 litres of diesel fuel per hour while ASD tug required 400 litres per hour with full load at the maximum RPM. Thus, it shows that the tractor tug is more efficient and economical to operate compare to the Azimuth Stern Drive tug. Despite these finding, other factors play vital role in determining the efficiency of the operation which including human factors, environmental condition, and mechanical factors. Due to these factors it is hard to determine the exact figure of ideal bollard pull capabilities of tugboats in Bintulu Port Malaysia.

ABSTRAK

Kajian untuk menentukan keupayaan *bollard pull* bot tunda yang ideal di Pelabuhan Bintulu Malaysia

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Pelabuhan Bintulu terkenal sebagai pelabuhan LNG bertaraf antarabangsa yang terletak strategik di laluan perdagangan laut yang sibuk antara laluan Negara barat dan perdagangan Eropah yang terletak di bahagian timur laut negeri Sarawak pada 03 darjah 16 minit Utara dan 113 darjah 04 minit Barat (Lembaga Pelabuhan Bintulu, 2011). Dengan penambahan dari segi saiz kapal dan bilangan kapal yang melabuh, ini adalah penting untuk mengetahui dan menentukan jumlah keupayaan *Bollard pull* gabungan yang ideal untuk bot tunda yang diperlukan di Pelabuhan Bintulu demi memastikan keselamatan dan kebekesanan dalam operasi pengendalian kapal serta menentukan jenis bot tunda yang paling ekonomik yang digunakan di Pelabuhan Bintulu. Jumlah *Bollard Pull* yang diperlukan untuk mengimbangkan daya dalaman dan daya luaran dikira dengan menggunakan formula-formula yang diguna pakai dalam publikasi OCIMF. Data angin dan ombak diperolehi daripada Jabatan Meteorologi Malaysia (JMM), Manakala data untuk arus di dalam perairan pelabuhan diperolehi dari Lembaga Pelabuhan Bintulu. Data untuk partikulasi bot tunda, Rekod Penggunaan Bot Bulanan, dan caj tunda diperolehi daripada Bintulu Port Sdn. Bhd. Untuk purata masa yang diambil antara bot tunda Traktor (Kipas *Voith-Schneider*) dan bot tunda *Azimuth Stern Drive* (Kipas *Schottel*), masa 1 jam 31 minit dan 1 jam 27 minit diperlukan untuk operasi pengendalian kapal LNG berlayar/berlepas. Untuk operasi kapal LNG masuk, masa purata yang diambil adalah 2 jam dan 25 minit dan 2 jam dan 22 minit. Tambahan pula, memandangkan pengiraan untuk caj menunda di Pelabuhan Bintulu berdasarkan kepada “Sistem Blok” mengikut keupayaan “*Bollard pull*” bot tunda, caj menunda untuk menempatkan kedua-dua jenis bot tunda pada operasi yang sama adalah sama. Walau bagaimanapun, dari segi kadar penggunaan minyak antara dua jenis bot tunda, bot tunda Traktor kelihatan lebih ekonomik untuk operasi berbanding bot tunda ASD yang mempunyai keupayaan *Bollard Pull* yang sama. Bot tunda Traktor menggunakan 300 liter minyak diesel per jam, manakala bot tunda ASD memerlukan 400 liter per jam dengan keadaan beban penuh pada RPM maximum. Justeru, ia menunjukkan bot tunda Traktor adalah lebih cekap and ekonomik berbanding bot tunda jenis ASD. Walau bagaimanapun, faktor lain memainkan peranan yang penting dalam menentukan kecekapan operasi termasuk factor manusia, keadaan alam sekitar, dan faktor mekanikal. Disebabkan faktor tersebut, ia adalah susah untuk menentukan keupayaan *bollard pull* ideal yang sebenar di Pelabuhan Bintulu Malaysia.