



CALCULATE THE ESTIMATED TANKER BERTHING TIME BASED ON THE AMOUNT OF ETHYLENE LOADED

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ABSTRACT

One of the problems that causes dwelling time remain high is the uncertainty of loading and unloading time also the time for documents processing. Impact this uncertainty is an additional cost being charged to ships by the authorities because of additional berthing time. Based on the berthing time report it is necessary to calculate the ideal time for processing document. Ship Document Processing include the clearance in document, processing document when the ship enter the port. Clearance out is processing document before the ship leave the port. Loading/Unloading process includes of loading/unloading preparation. Loading/unloading preparation activities for Ethylene must be carried out by following appropriate procedures, this is because ethylene is volatile and flammable hazardous material. In fact Activities involving dangerous goods are regulated separately in International Maritime Organisation Regulations.

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Kata Kunci : Berthing Time, Loading, Unloading

1. INTRODUCTION

Along with the development of increasingly sophisticated technology, ships as a main of transportation at sea have progressed a lot in term of size and technology used. At this time various kinds of cargo can be transported by using of ships. The type of ship used to transport cargo in liquid or gas form is a tanker.

Ethylene is a dangerous material because it volatile and flammable, therefore any activities involving hazardous materials is specifically regulated by International Maritime Organisation, the International Convention on safety of life at Sea (Solas) chapter VII and Standar “Carriage of Dangerous Goods” (Rukavina 2020). For officer on duty on Liquefied gas Tanker must have minimum requirement qualification as regulated in International

Convention on Standar of Training, Certification and Watchkeeping for seafarers 2010 (STCW 2010) Chapter V Regulation V 1-2-1 for Basic qualification for liqified gas tanker cargo operations and Chapter V Regulation V 1-2-2 for Advance qualification for liqified gas tanker cargo

Activities loading/Unloading Ethylene from and to the ship must comply with strict procedures and also carried out by competence officer on duty, to reduce the risk during loading/unloading process.

Ship berthing time for Ethylene cargoes consists of three different process, Clearence in process, loading/unloading process, Clearence out process. Based on

Based on the berthing time report for ships with eteline cargo, the estimated berthing time is calculated. It is hoped that with this calculation more certain ertimated berthing time, it will be easier to scheduling ships to enter the port. It is also to make sure the productivity process loading/unloading more efficient without ignoring safety factor..

2. METHODE

According on the data activity report of ship visiting at PT XXX which carries out clearence in activities, loading/unloading activities and Clearence out activities, Statistic calculations will be carried out to obtain a more precise time estimation, for each activities during the berthing time. From statistical calculations It is hoped that this can be used as a benchmark for each activity, so that a more certain berthing time can be estimated.

In order to obtain a more certain estimate of berthing time, it is necessary to calculate the average time of clearance in, loading/unloading, clearance out, normality test of for clearance in, loading/unloading, clearance out, correlation between amount of cargo

on loading/unloading time, as well as the regression between of the amount of cargo on loading/unloading time.

3. RESULT AND DISCUSSION

When the ship docks at the port there are three different activities, that is clearance in process which documents are checked just before the loading and unloading of goods is carried out, the next activity is the process of unloading or loading of goods into or from the ship, the last process is Clearance out is the process inspection of documents after the process of unloading or loading the ship and before the ship is permitted to leave the port.

Based to Ship Visiting data report at PT XXX with ethylene cargo from August 2018 to July 2019 the following data is Obtained:

3.1 Clearance In and Clearance Out Process

Table 1 Time Table of CI and CO Process

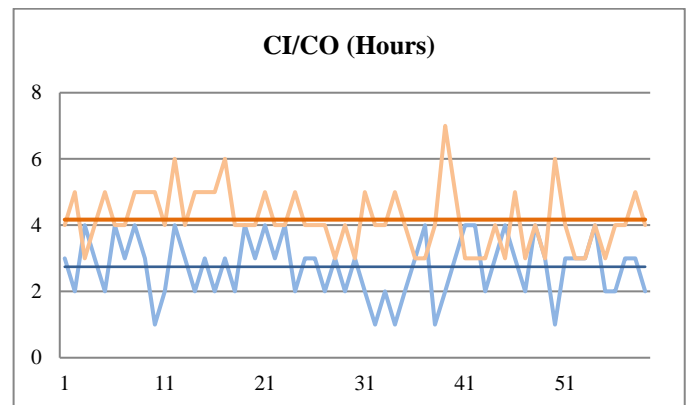


Table 2 Statistic of CI and CO Process

		Descriptives			
		Clearance In		ClearanceOut	
		Statistic	Std. Error	Statistic	Std. Error
Mean		2.75	.117	4.17	.119
95% Confidence Interval for Mean	Lower Bound	2.51		3.93	
	Upper Bound	2.98		4.41	
5% Trimmed Mean		2.77		4.11	
Median		3.00		4.00	
Variance		.814		.833	
Std. Deviation		.902		.913	
Minimum		1		3	
Maximum		4		7	
Range		3		4	
Interquartile Range		1		1	

Skewness	-.196	.311	.638	.311
Kurtosis	-.727	.613	.456	.613

According on the Descriptive Statistic table, result show that average time for Clearance In Process is 2.75 hours with variance data is 0.814, while for Clearance Out process it takes an average is 4.17 hours with variance data. Range of mean with interval convidence 95% for Clearance in ($2.51 \leq \mu_{CI} \leq 2.98$), and for Clearance out Jam ($3.93 \leq \mu_{CO} \leq 4.41$).

To Calculate the difference mean for Clearance In process and Clearance Out Proces it is necessary to carry out an Independent sample t-test, with a hypothesis:

$$H_0 : \mu_{ci} = \mu_{co}$$

$$H_1 : \mu_{ci} \neq \mu_{co}$$

H_0 rejected if significance of Indepen sample t test < 0.05

Table 3 Independen Sample Test

	t-test for Equality of Means						
	t	df	Sig.	Mean	Std. Error	95% Confidence Interval	
						Lower	Upper
Equal variances assumed	-8.52	116	.000	-1.423	.167	-1.754	-1.092
Equal variances not assumed	-8.52	116	.000	-1.423	.167	-1.754	-1.092

Significance value of Independent sample t test is 0.00, ($0.00 < 0.05$), this is resulted H_0 being rejected, or there was difference mean of Clearance In process with mean of Clearance Out process ($\mu_{CI} \neq \mu_{CO}$). Difference value of means between Clearance In process and Clearance Out process are 1.423 Hours. Clearance Out process takes 1.423 hours longer than Clearance In process.

To ensure Clearance in process with interval convidence 95 % ($2.51 \leq \mu_{CI} \leq 2.98$) and Clearance out process with interval convidence 95 % ($3.93 \leq \mu_{CO} \leq 4.41$) valid, It is necessary to carry out

Normality test for Clearance in and Clearance out Process with Hypothesis

H_0 : Clearance In Process have a normal distribution

H_1 : Clearance In Process din not have a normal distribution

Or

H_0 : Clearance Out Process have a normal distribution

H_1 : Clearance Out Process din not have a normal distribution

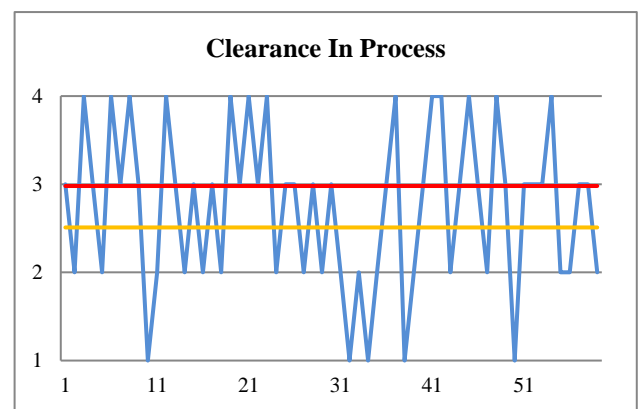
H_0 rejected if significance of Normality test < 0.05

Table 4 CI Normality Test

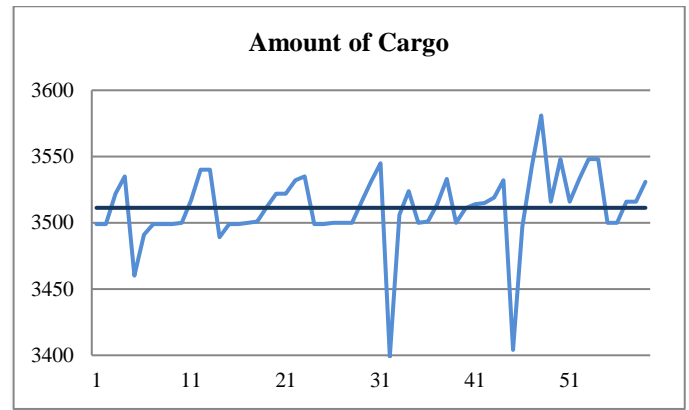
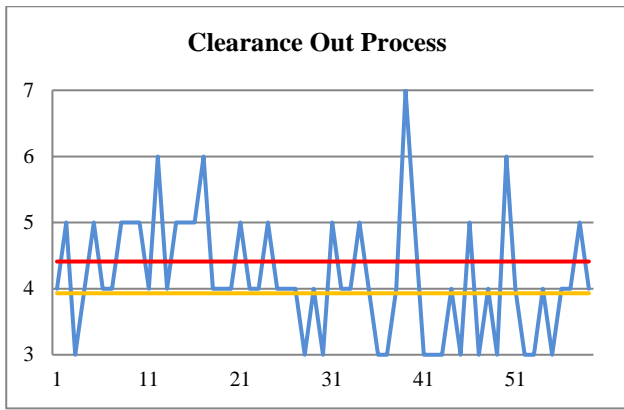
	Kolmogorov-Smirnov ^a		
	Stat	df	Sig.
Clearance In	.221	59	.000
Clearance Out	.252	59	.000

Kolmogorov smirnov Normality test for Clearance In process show that value of Significance $0.00 < 0.05$, as well as Clearance Out Process Kolmogorov smirnov Normality test show the value of significance $0.00 < 0.05$. this means that both process did not have normal distribution.

Graphic1 CI With Lower and Upper bound

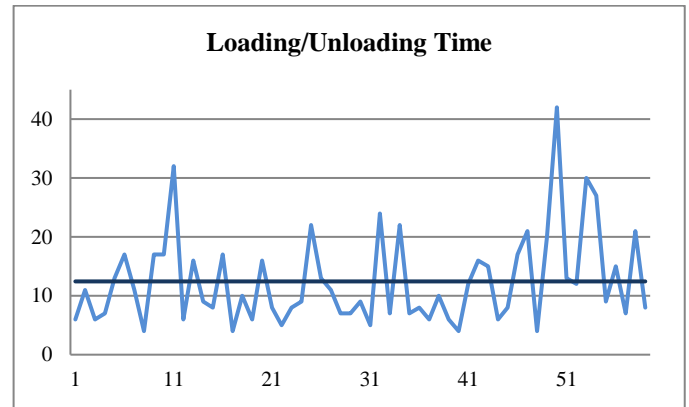


Graphic2 CO With Lower and Upper bound



As shown in graphic Clearance In and Clearance Out Process, most of the time it takes for Clearance In and Clearance out Process outside in area upper bound (red line ()) and lower bound (orange line ()). Boundary Clearance In Process are with confidency 95 % are $2.51 \leq \mu_{CI} \leq 2.98$ and Boundary Clearance Out Process are with confidency 95 % $3.93 \leq \mu_{CO} \leq 4.41$.

Graphic 4 Time of Loading/Unloading Process



3.2 Amount of Cargo and Loading/Unloading Process

In General Loading/unloading time process proportional with amount of Cargo. To find out the level of loading and loading time process between Amount of Cargo, it is necessary to test:

- A. Correlation test between Amount of cargo and loading/unloading time process.
- B. Linear Regression test Amount of cargo and loading/unloading time process.

Table 5 Statistic of Amount of Cargo

		Amount Of Cargo		Loading/Unloading time	
		Statistic	Std. Error	Statistic	Std. Error
Mean		3511.29	3.735	12.44	1.011
95% Confidence Interval for Mean	Lower Bound	3503.81		10.42	
	Upper Bound	3518.76		14.47	
5% Trimmed Mean		3513.68		11.67	
Median		3514.00		10.00	
Variance		823.140		60.354	
Std. Deviation		28.690		7.769	
Minimum		3399		4	
Maximum		3581		42	
Range		182		38	
Interquartile Range		32		10	
Skewness		-1.623	.311	1.547	.311
Kurtosis		6.258	.613	2.863	.613

Average number amount of cargo based on statistical calculation are 35.29 (MT), for Interval confidence 95 % $3503.81 \leq \mu_{\text{Amount of Cargo}} \leq 3518.76$. As for loading/unloading time process an mean 12.44 Hours was obtained with an interval of $10.42 \leq$

μ Unloading/loading time ≤ 14.47 for a 95% confidence level.

Correlation Test

To find out relationship between amount of cargo and loading/unloading time process, it is necessary to do a correlation test between amount of cargo and loading/unloading time process. Hypothesis for correlation between amount of Cargo and loading/unloading time process is:

- H_0 : Amount of Cargo has correlation with the loading/unloading time.
 H_1 : Amount of Cargo has no correlation with the loading/unloading time.

H_0 is rejected if the value of significance (2-tailed) > 0.05

Table 6 of Pearson Correlation

		Amount of Cargo	Loading/Unloading Time
Amount of Cargo	Pearson Correlation	1	.045
	Sig. (2-tailed)		.735
	N	59	59
Loading/Unloading Time	Pearson Correlation	.045	1
	Sig. (2-tailed)	.735	
	N	59	59

Significance value (2-tailed) for Pearson correlation as shown in table is 0,735. Pearson correlation Significance value > 0.05, means H_0 rejected. Or Amount of Cargo has no correlation with the loading/unloading time process.

Linear Regression Test

The objective of the linear regression test is to formulate the loading/Unloading time Process according to amount of Cargo

$$y = a . x + b$$

y = Loading/Unloading time

x = Amount of Cargo

a =Koefficient of Amount of Cargo

b = Constanta

Linear regression test carried out by taking variable Amount of cargo as the independent variable and loading/unloading time as dependent variable.

Hypothesis for Linear regression test is:

- H_0 : Amount of Cargo can be used to predict loading/unloading process
 H_1 : Amount of Cargo cannot be used to predict loading/unloading process

H_0 is rejected if the value of significance (2-tailed) > 0.05

Table 7 of linear regression model

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.045 ^a	.002	-.015	7.829

Table 8 Table of Anova
ANOVA^a

Model	Sum of Squares	df	Mean Square	F	Sig.
1 Regression	7.083	1	7.083	.116	.735 ^b
Residual	3493.459	57	61.289		
Total	3500.542	58			

Table 9 Coefficients linear regression model

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	-30.328	125.812		-.241	.810
	Amount of Cargo	.012	.036	.045	.340	.735

According of General model for linear regression and statistical calculation result obtained:

$$y = 0.012 . x - 30.328$$

y = Loading/Unloading time

x = Amount of Cargo

From Anova Table show that value of significance is $0,735 > 0,05$ means Amount of Cargo cannot be used to predict loading/unloading process

C. Comparison Berthing Time based on Statistical Calculation with Actual Berthing Time Data

Berthing time process influenced by three main activities there are:

1. Clearance in Process
2. Loading/Unloading Time Process
3. Clearance Out Process.

Of the three processes above, berthing time can be made into an equation:

$$BT = CI + LU + CO$$

BT = Berthing Time

CI = Clearance in with boundary $2.51 \leq CI \leq 2.98$

for confidence interval 95 %

CI = Clearance out with boundary $3.93 \leq CO \leq 4.41$

for confidence interval 95 %

LU = Loading/Unloading Process with

$$y = 0.012 \cdot x - 30.328$$

Lower Bound for Berthing Time

$$BT = CI + LU + CO$$

$$BT = 2.51 + (0.012 \cdot x - 30.328) + 3.93$$

$$BT = 0.012 \cdot x - 23.888$$

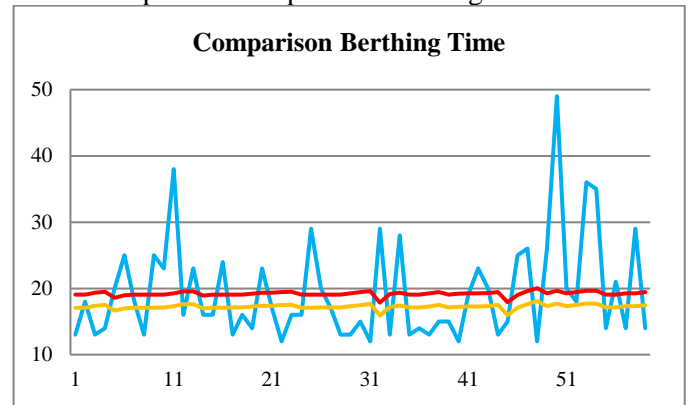
Upper Bound for Berthing Time

$$BT = CI + LU + CO$$

$$BT = 2.98 + (0.012 \cdot x - 30.328) + 4.41$$

$$BT = 0.012 \cdot x - 22.938$$

Graphic 5 Comparison Berthing Time



Comparison between statistical Calculation and Actual berthing data show that, most of actual berthing time data does not lie in area between lower bound and upper bound area.

4. CONCLUSION

According from statistical calculation result obtained:

Table 9 Berthing Time Process

Process	Result	Conclusion
Clearance In	$(2.51 \leq \mu_{CI} \leq 2.98)$	Not normal distribution
Clearance Out	$(3.93 \leq \mu_{CO} \leq 4.41)$	Not normal distribution
Loading/unloading	$0.012x - 30.328$	<ul style="list-style-type: none"> • Amount of Cargo did not have correlation with Loading/Unloading process • Amount of Cargo cannot be used to predict loading/unloading process
Berthing Time	$0.012x - 23.888$ $0.012x - 22.938$	most of actual berthing time data does not lie in area between lower bound and upper bound area

From table of berthing time process, data report of the berthing time of ship with ethylene cargo at PT XXX are not strong enough to be used as a foundation for estimating berthing time based on the amount of Cargo.

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