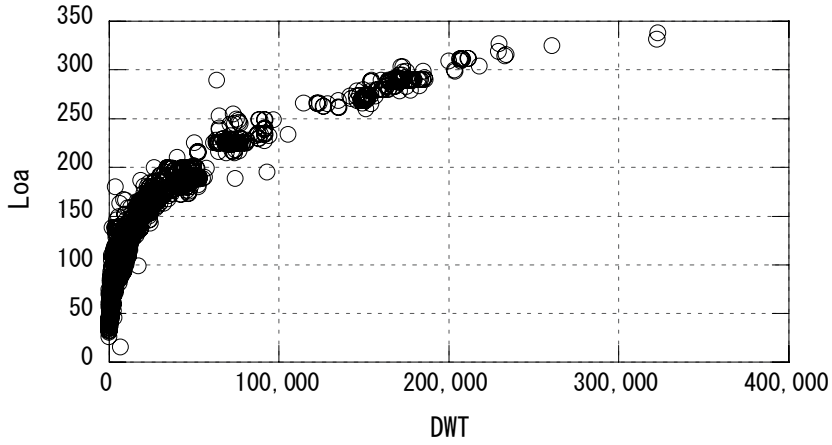



**Figure 3-1** Cargo Ship Loa-DWT

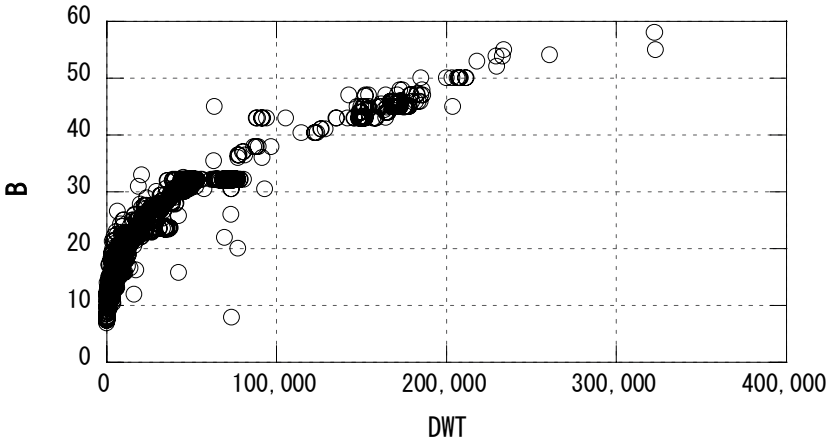



**Figure 3-2** Cargo Ship B-DWT

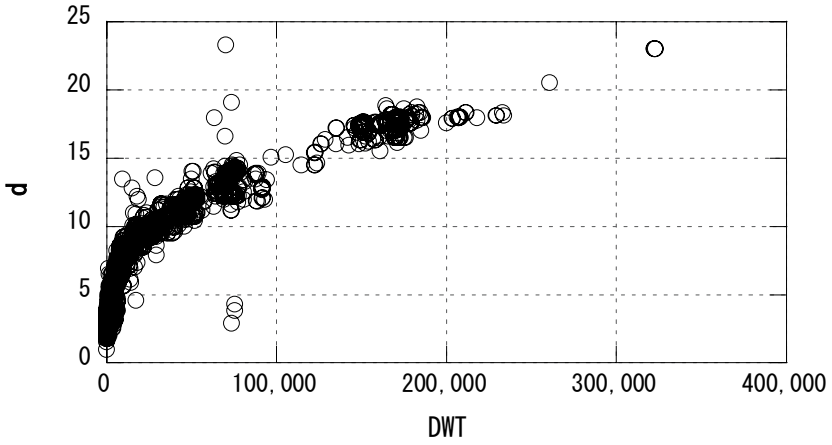
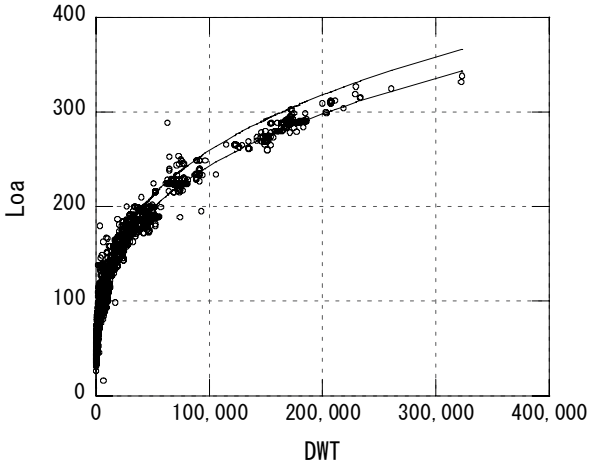
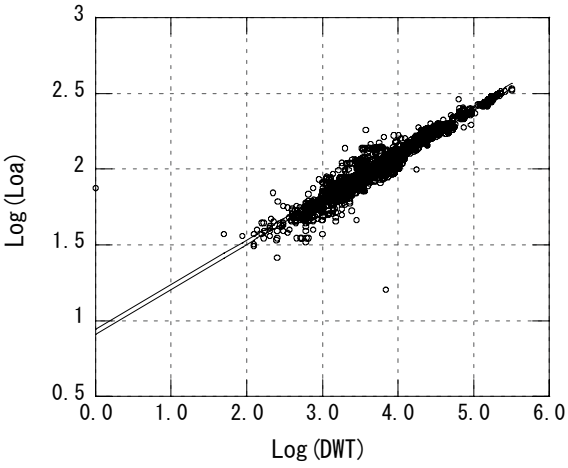



**Figure 3-3** Cargo Ship d-DWT




$Y=\alpha \cdot X^{\beta}$

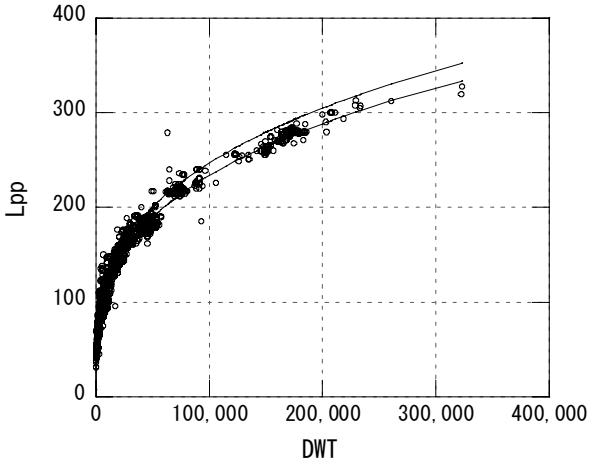
$\log Y=a+b\log X$

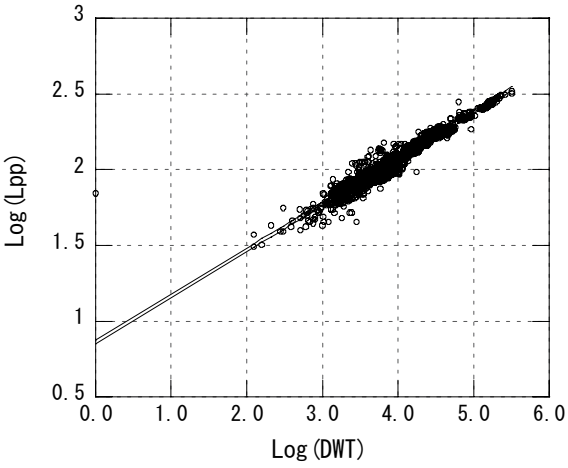
( $R^2=$ 0.957 , $\sigma=$ 0.042 )

| | 50% | 75% |
|---|---|---|
| α | 8.1823 | 8.7338 |
| β | 0.2945 | 0.2945 |

| | 50% | 75% |
|---|---|---|
| a | 0.9129 | 0.9412 |
| b | 0.2945 | 0.2945 |

**Figure 3-4** Cargo Ship Loa-DWT




$Y=\alpha \cdot X^{\beta}$

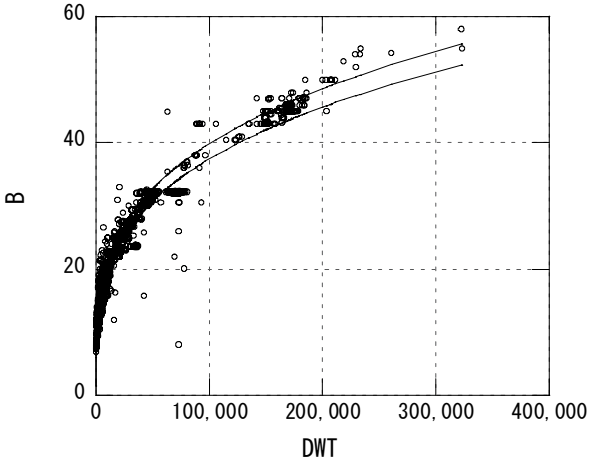
$\log Y=a+b\log X$

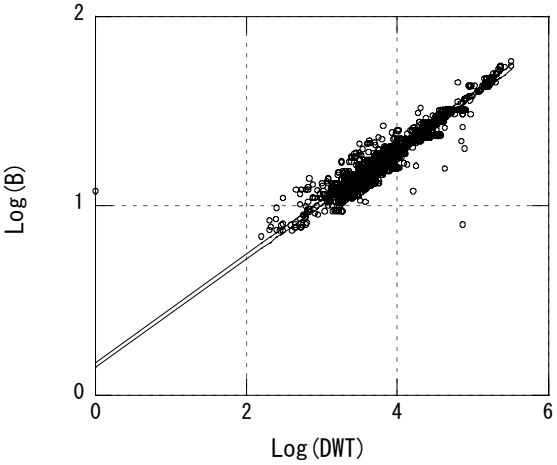
( $R^2=$ 0.963 , $\sigma=$ 0.036 )

| | 50% | 75% |
|---|---|---|
| α | 7.0837 | 7.4863 |
| β | 0.3037 | 0.3037 |

| | 50% | 75% |
|---|---|---|
| a | 0.8503 | 0.8743 |
| b | 0.3037 | 0.3037 |

**Figure 3-5** Cargo Ship Lpp-DWT




$Y=\alpha \cdot X^{\beta}$

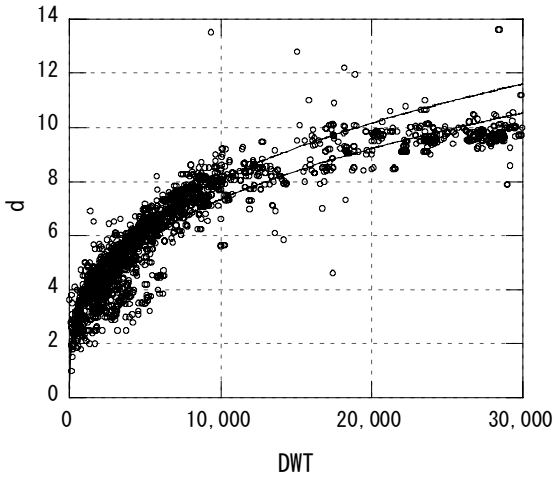
| | 50% | 75% |
|---|---|---|
| α | 1.4074 | 1.4974 |
| β | 0.2850 | 0.2850 |

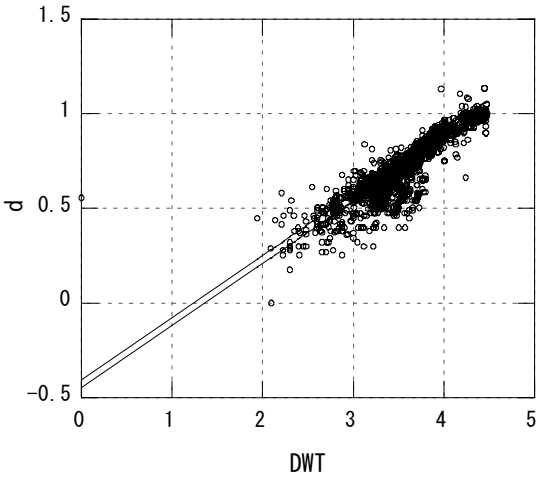
logY=a+blogX

( $R^2$= 0.951 , σ= 0.040 )

| | 50% | 75% |
|---|---|---|
| a | 0.1484 | 0.1753 |
| b | 0.2850 | 0.2850 |

**Figure 3-6** Cargo Ship B-DWT




$Y=\alpha \cdot X^{\beta}$

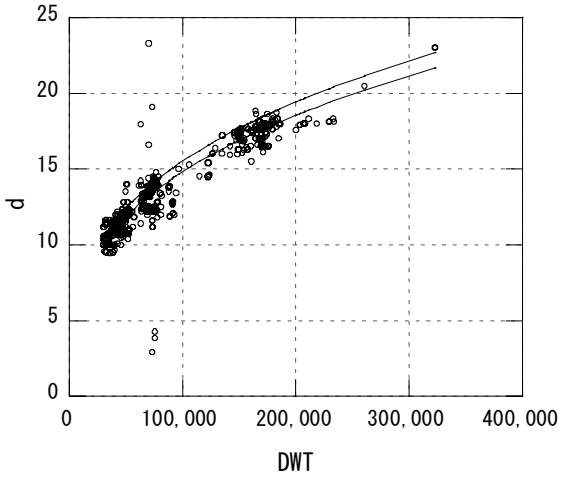
| | 50% | 75% |
|---|---|---|
| α | 0.3570 | 0.3935 |
| β | 0.3282 | 0.3282 |

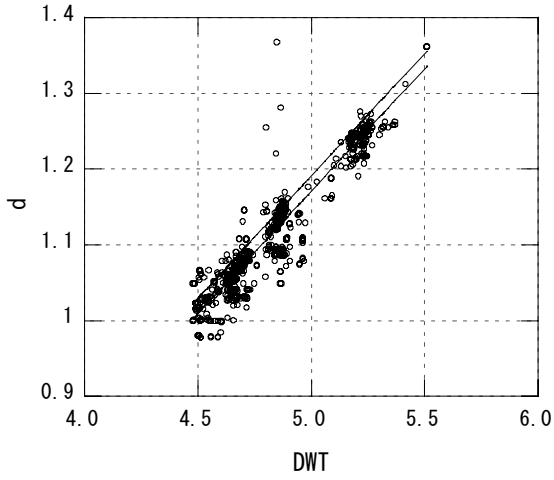
logY=a+blogX

( $R^2$= 0.847 , σ= 0.063 )

| | 50% | 75% |
|---|---|---|
| a | -0.4473 | -0.4051 |
| b | 0.3282 | 0.3282 |

**Figure 3-7** Cargo Ship（～Less than 30,000DWT）d-DWT




$Y=\alpha \cdot X^{\beta}$

| | 50% | 75% |
|---|---|---|
| α | 0.3585 | 0.3754 |
| β | 0.3233 | 0.3233 |

logY=a+blogX

( $R^2$= 0.850 , σ= 0.030 )

| | 50% | 75% |
|---|---|---|
| a | -0.4455 | -0.4255 |
| b | 0.3233 | 0.3233 |

**Figure 3-8** Cargo Ship（30,000DWT～） d-DWT

### 3.2 Container Ship

**Figure 3-9** to **Figure 3-11** show the results of analysis of Loa, B, and d for DWT. For container ships, both an analysis of all ships, and analyses by dividing all ships into Under-PANAMAX , PANAMAX , and Over-PANAMAX were done. And the number of containers that can be loaded (TEU unit, below written "TEU") was analyzed and the results of analysis of TEU for DWT are also shown in **Figure 3-12**.

(1) Analysis encompassing all ships

All main dimensions, Loa, Lpp, B, and d were analyzed by dividing the ships into two classes at 35,000DWT and applying the logarithmic regression analysis method to those less than 35,000DWT. As a result, $R^2$ = 0.931 was obtained for Loa, $R^2$ = 0.933 for Lpp, $R^2$ = 0.918 for B, and $R^2$ = 0.930 for d. Then those of 35,000DWT or more were divided into 10,000DWT units as shown below, and analyzed by the average value analysis method. Because there are almost no data for ships of 85,000DWT or more but less than 95,000DWT, ships in these classes were not analyzed. **Figure 3-13** to **Figure 3-40** show results of analysis for each dimension. **Table 3-2** shows the results of analysis of each main dimension according to the ship classes that were set.

The value for B in the 40,000DWT class and the 50,000DWT class were, assuming they are Panamax type, set at 32.3m instead of an analytic value.

- 35,000DWT or higher, less than 45,000DWT
- 45,000DWT or higher, less than 55,000DWT
- 55,000DWT or higher, less than 65,000DWT
- 65,000DWT or higher, less than 75,000DWT
- 75,000DWT or higher, less than 85,000DWT
- 95,0000DWT or higher

**Table 3-2** The results of analysis of main dimensions (Container Ship)

| Dead Weigth Tonnage (t) | Length Overall (m) | Length P.P. (m) | Breadth Molded (m) | Full Load Draft (m) | Reference：the number of containers that can be loaded (*TEU*) |
|---|---|---|---|---|---|
| 10,000 | 139 | 129 | 22.0 | 7.9 | 500～ 890 |
| 20,000 | 177 | 165 | 27.1 | 9.9 | 1,300～1,600 |
| 30,000 | 203 | 191 | 30.6 | 11.2 | 2,000～2,400 |
| 40,000 | 241 | 226 | 32.3 | 12.1 | 2,800～3,200 |
| 50,000 | 274 | 258 | 32.3 | 12.7 | 3,500～3,900 |
| 60,000 | 294 | 279 | 35.9 | 13.4 | 4,300～4,700 |
| 100,000 | 350 | 335 | 42.8 | 14.7 | 7,300～7,700 |

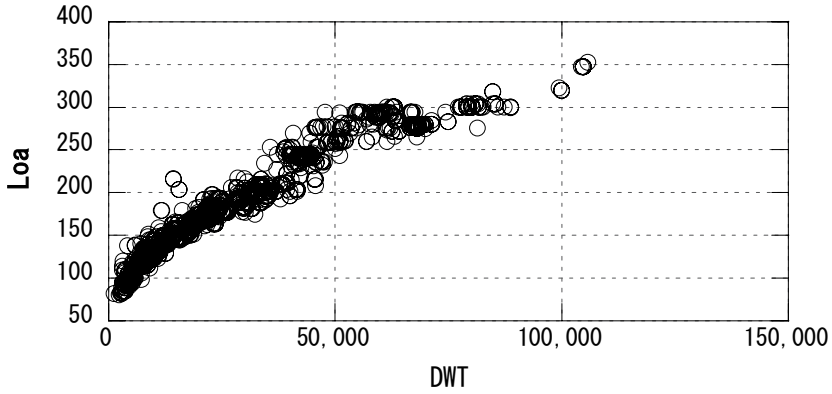



**Figure 3-9** Container Ship Loa-DWT

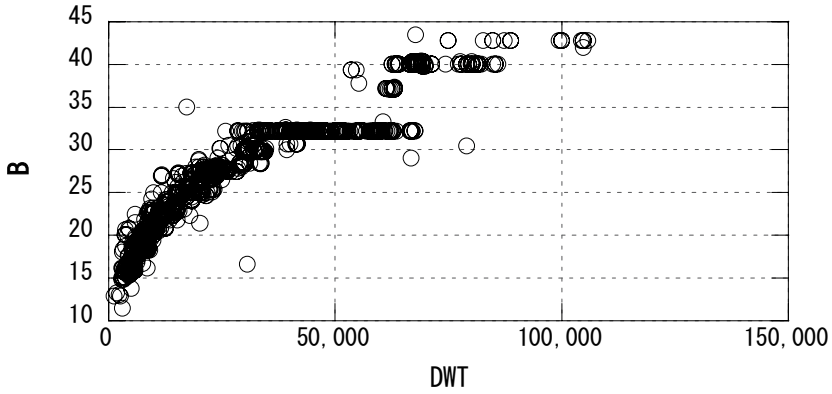



**Figure 3-10** Container Ship B-DWT

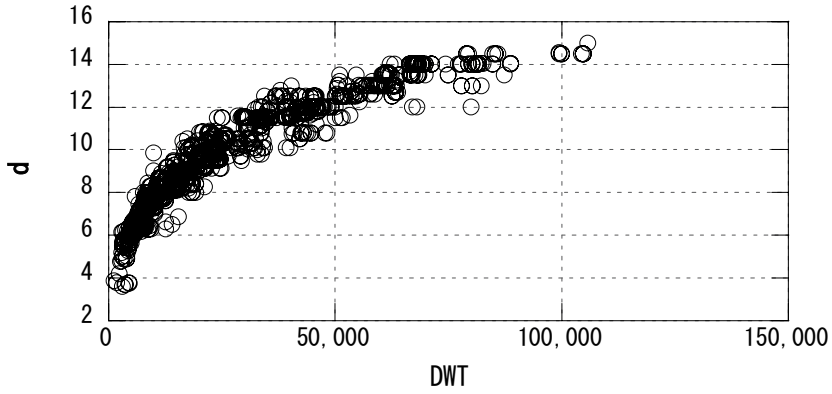



**Figure 3-11** Container Ship d-DWT

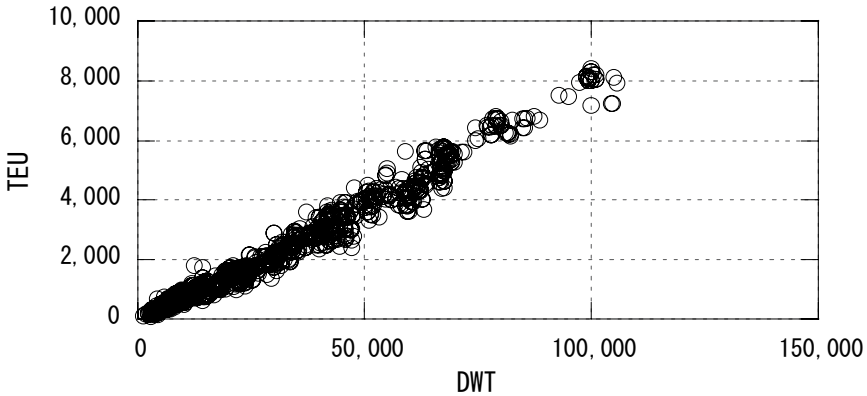
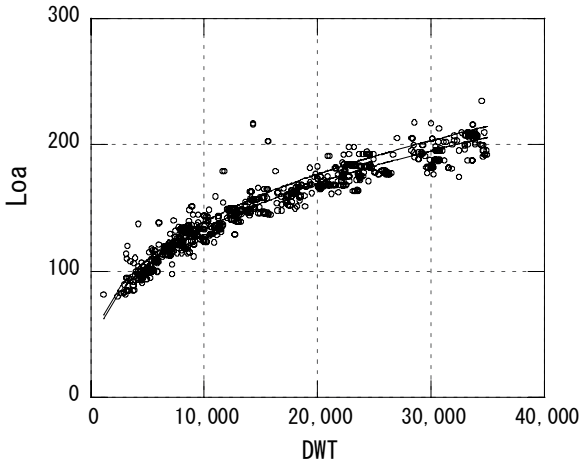
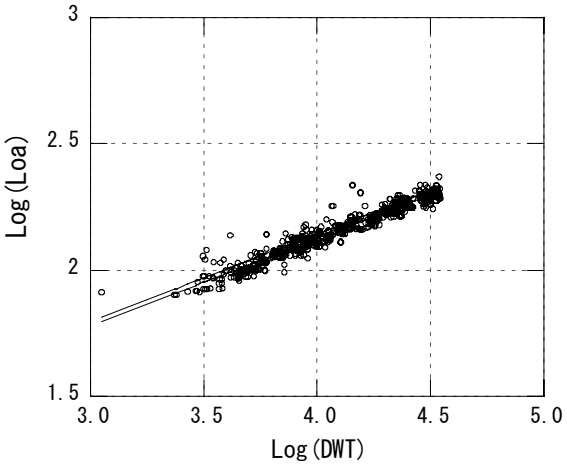



**Figure 3-12** Container Ship TEU-DWT




$Y=\alpha \cdot X^{\beta}$

| | 50% | 75% |
|---|---|---|
| α | 5.4569 | 5.6834 |
| β | 0.3470 | 0.3470 |

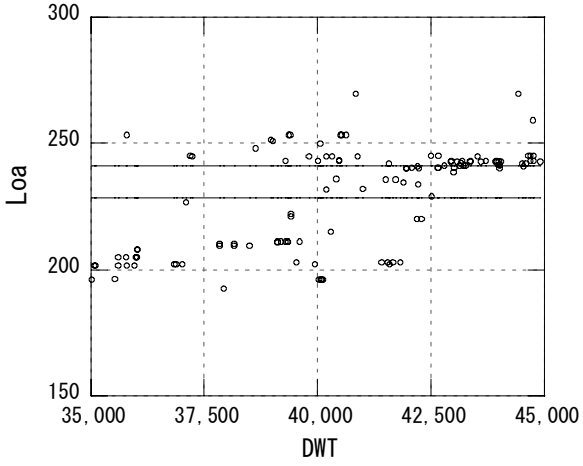



$\log Y=a+b\log X$

( $R^2$= 0.931 , σ= 0.026 )

| | 50% | 75% |
|---|---|---|
| a | 0.7369 | 0.7546 |
| b | 0.3470 | 0.3470 |

**Figure 3-13** Container Ship（～Less thsn 35,000DWT）Loa-DWT

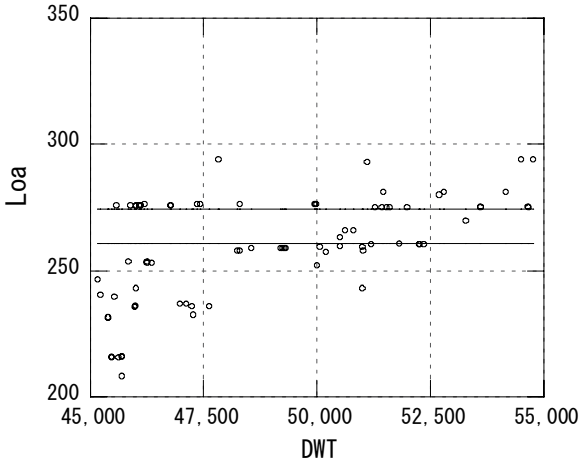



$Y=a_0$

（σ= 18.919 ）

| | Average | 75% |
|---|---|---|
| $a_0$ | 228.4 | 241.2 |

**Figure 3-14** Container Ship
（35,000～Less than 45,000DWT）Loa-DWT

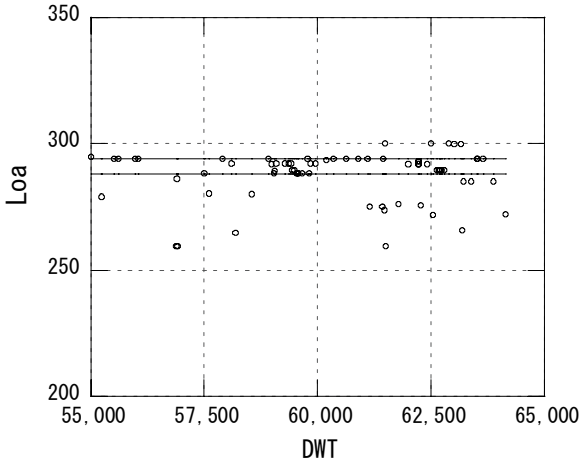



$Y=a_0$

（σ= 20.015 ）

| | Average | 75% |
|---|---|---|
| $a_0$ | 260.8 | 274.3 |

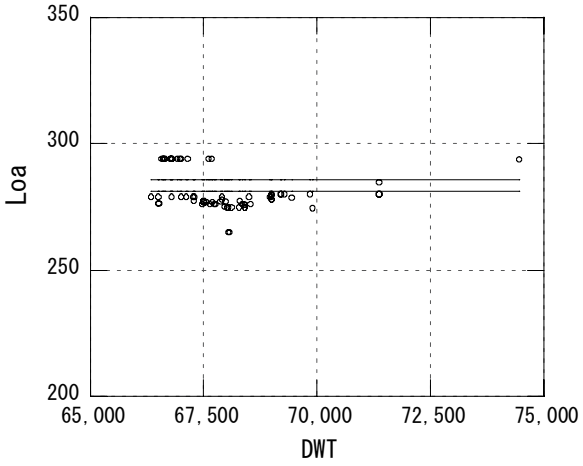
**Figure 3-15** Container Ship
（45,000～Less than 55,000DWT）Loa-DWT




$Y=a_0$
（σ= 9.184 ）

| | Average | 75% |
|---|---|---|
| $a_0$ | 287.9 | 294.1 |

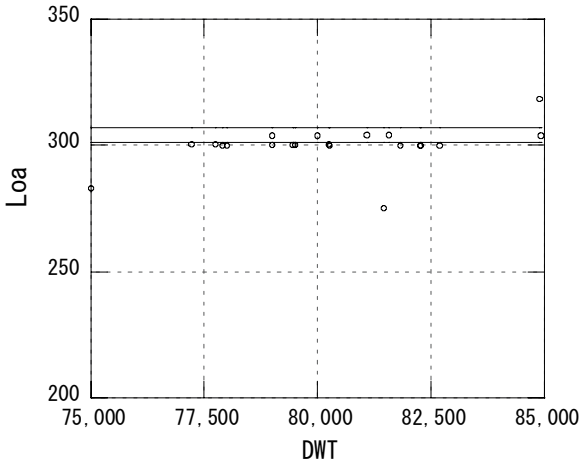
**Figure 3-16** Container Ship
（55,000～Less than 65,000DWT） Loa-DWT




$Y=a_0$
（σ= 7.076 ）

| | Average | 75% |
|---|---|---|
| $a_0$ | 281.2 | 286.0 |

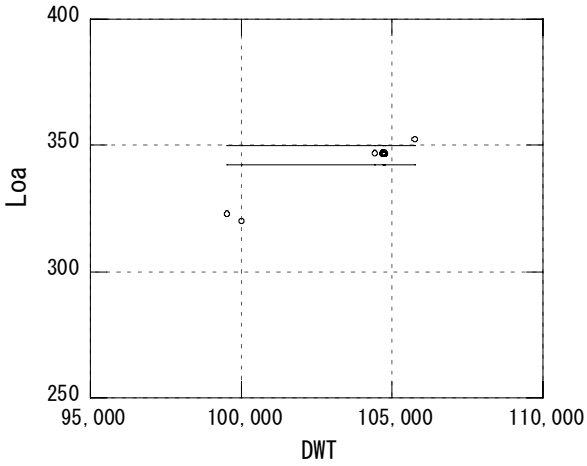
**Figure 3-17** Container Ship
（65,000～Less than 75,000DWT） Loa-DWT




$Y=a_0$
（σ= 8.716 ）

| | Average | 75% |
|---|---|---|
| $a_0$ | 301.1 | 307.0 |

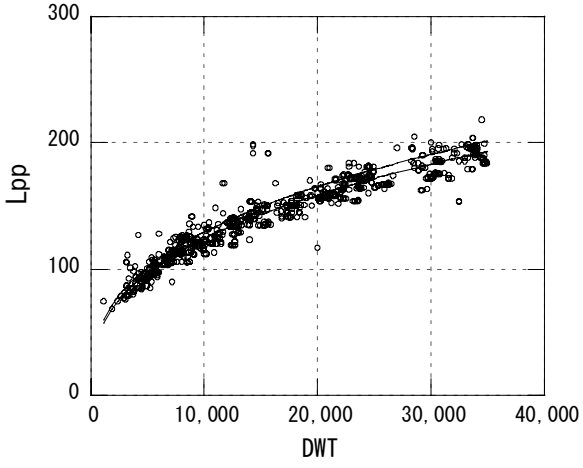
**Figure 3-18** Container Ship
（75,000～Less than 85,000DWT） Loa-DWT

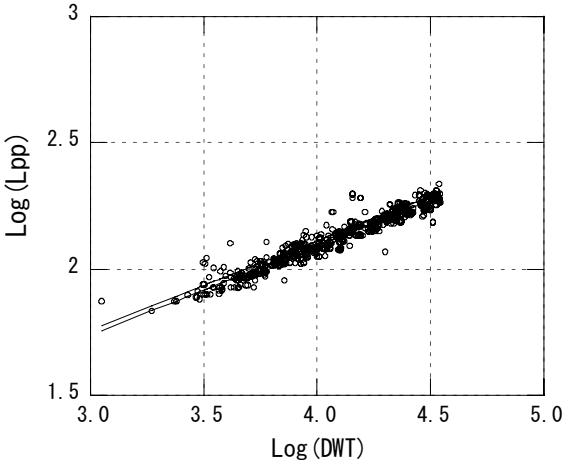



$Y=a_0$
（σ= 11.269 ）

| | Average | 75% |
|---|---|---|
| $a_0$ | 342.3 | 349.9 |

**Figure 3-19** Container Ship
（95,000DWT～） Loa-DWT




$Y=\alpha \cdot X^{\beta}$

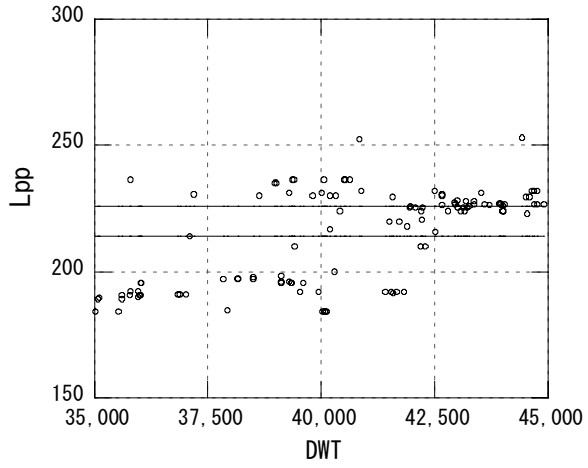
| | 50% | 75% |
|---|---|---|
| α | 4.7700 | 4.9714 |
| β | 0.3538 | 0.3538 |

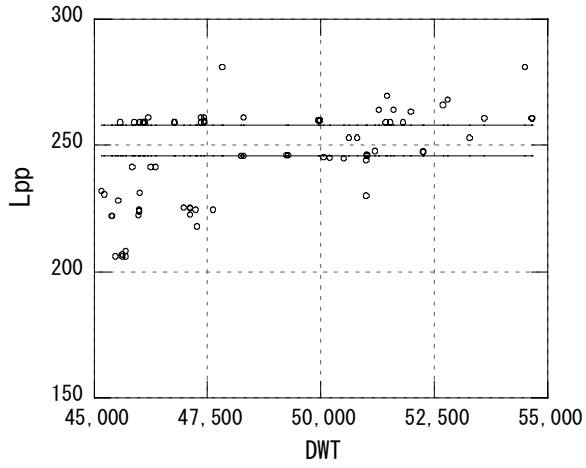
$\log Y=a+b\log X$

( $R^2$= 0.933 , σ= 0.027 )

| | 50% | 75% |
|---|---|---|
| a | 0.6785 | 0.6965 |
| b | 0.3538 | 0.3538 |

**Figure 3-20** Container Ship（～Less than 35,000DWT） Lpp-DWT




$Y=a_0$

（σ= 17.656 ）

| | Average | 75% |
|---|---|---|
| $a_0$ | 213.9 | 225.8 |

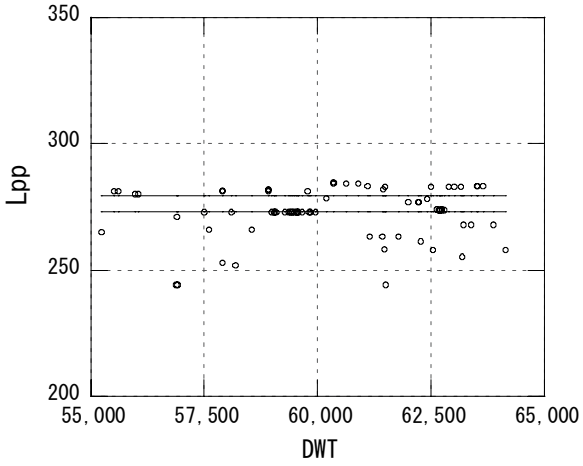
**Figure 3-21** Container Ship
（35,000～Less than 45,000DWT） Lpp-DWT

$Y=a_0$

（σ= 18.019 ）

| | Average | 75% |
|---|---|---|
| $a_0$ | 246.0 | 258.1 |

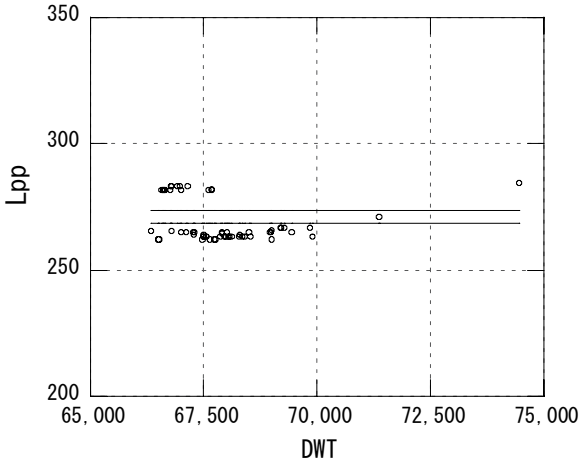
**Figure 3-22** Container Ship
（45,000～Less than 55,000DWT） Lpp-DWT




$Y=a_0$
（σ= 9.413 ）

| | Average | 75% |
|---|---|---|
| $a_0$ | 273.1 | 279.5 |

**Figure 3-23** Container Ship
（55,000～Less than 65,000DWT） Lpp-DWT

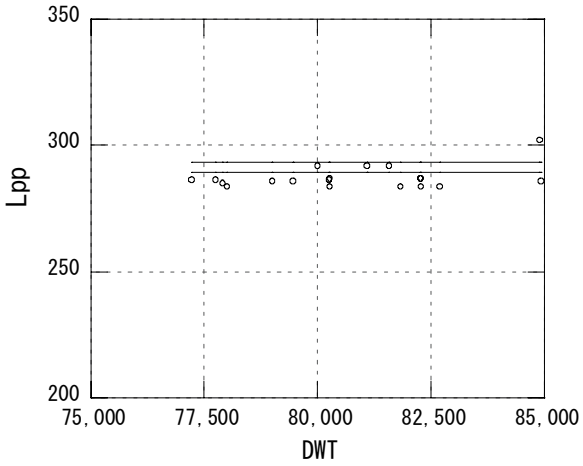



$Y=a_0$
（σ= 7.761 ）

| | Average | 75% |
|---|---|---|
| $a_0$ | 268.4 | 273.6 |

**Figure 3-24** Container Ship
（65,000～Less than 75,000DWT） Lpp-DWT

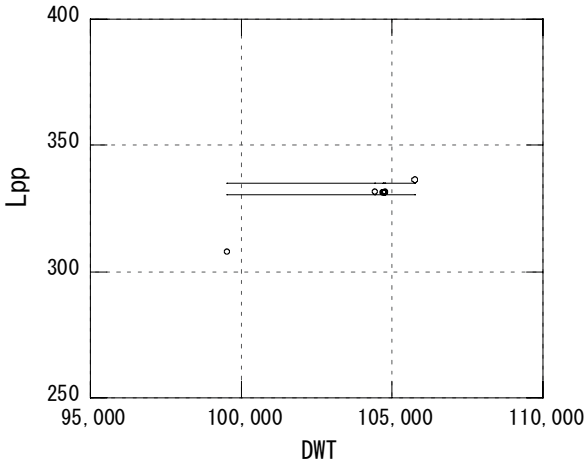
,




$Y=a_0$
（σ= 5.961 ）

| | Average | 75% |
|---|---|---|
| $a_0$ | 289.2 | 293.2 |

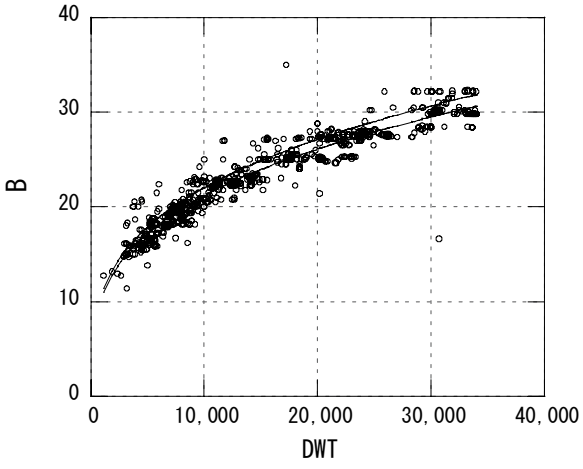
**Figure 3-25** Container Ship
（75,000～Less than 85,000DWT） Lpp-DWT




$Y=a_0$
（σ= 6.986 ）

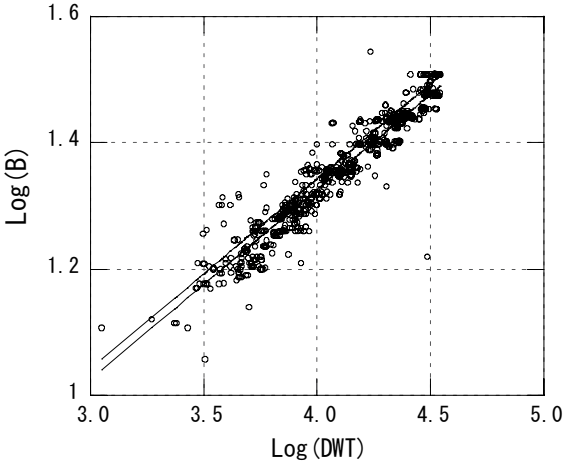
| | Average | 75% |
|---|---|---|
| $a_0$ | 330.4 | 335.1 |

**Figure 3-26** Container Ship
（95,000DWT～） Lpp-DWT




$Y=\alpha \cdot X^{\beta}$

| | 50% | 75% |
|---|---|---|
| α | 1.3229 | 1.3750 |
| β | 0.3011 | 0.3011 |

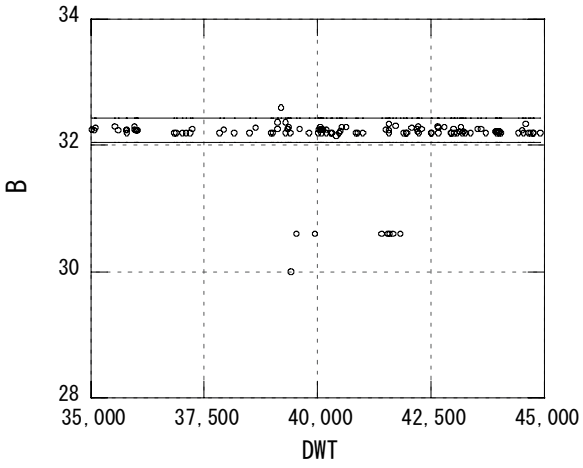



logY=a+blogX

( $R^2$= 0.918 , σ= 0.025 )

| | 50% | 75% |
|---|---|---|
| a | 0.1215 | 0.1383 |
| b | 0.3011 | 0.3011 |

**Figure 3-27** Container Ship （～Less than 35,000DWT） B-DWT

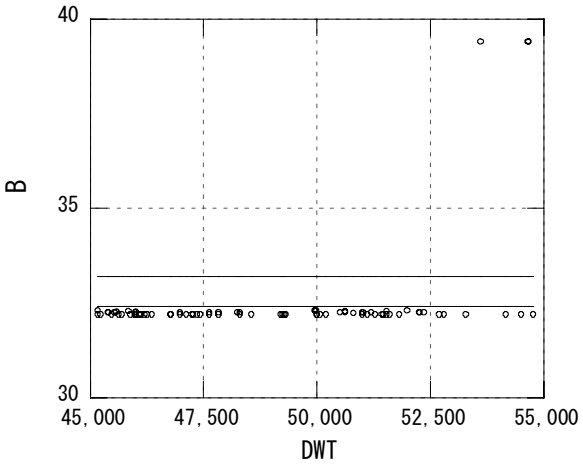



$Y=a_0$

（σ= 0.569 ）

| | Average | 75% |
|---|---|---|
| $a_0$ | 32.0 | 32.4 |

**Figure 3-28** Container Ship
（35,000～Less than 45,000DWT） B-DWT

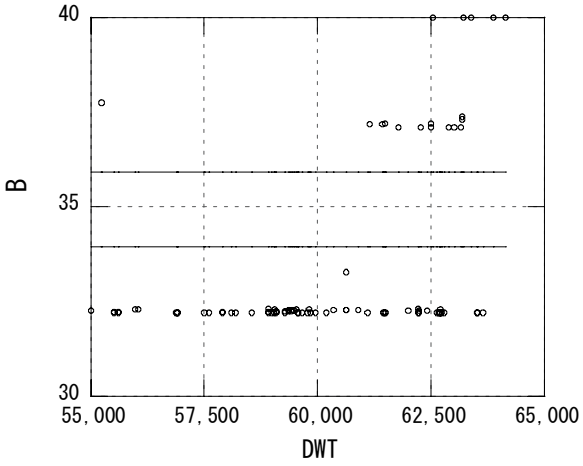



$Y=a_0$

（σ= 1.176 ）

| | Average | 75% |
|---|---|---|
| $a_0$ | 32.4 | 33.2 |

**Figure 3-29** Container Ship
（45,000～Less than 55,000DWT） B-DWT

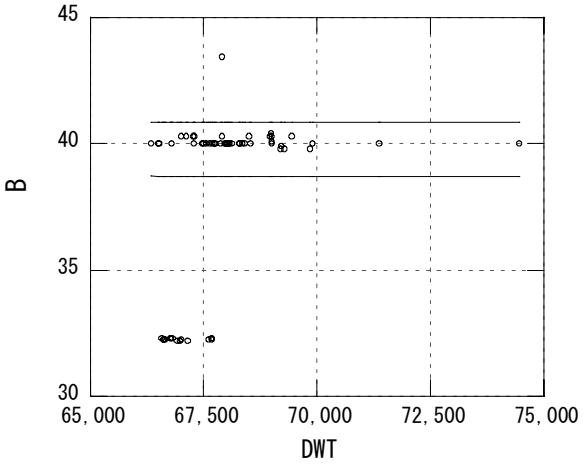



$Y=a_0$

（σ= 2.926 ）

| | Average | 75% |
|---|---|---|
| $a_0$ | 34.0 | 35.9 |

**Figure 3-30** Container Ship
（55,000～Less than 65,000DWT） B-DWT

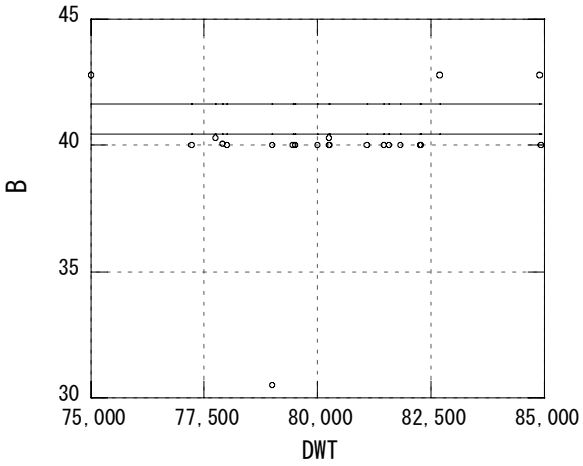



$Y=a_0$

（σ= 3.193 ）

| | Average | 75% |
|---|---|---|
| $a_0$ | 38.7 | 40.9 |

**Figure 3-31** Container Ship
（65,000～Less than 75,000DWT） B-DWT

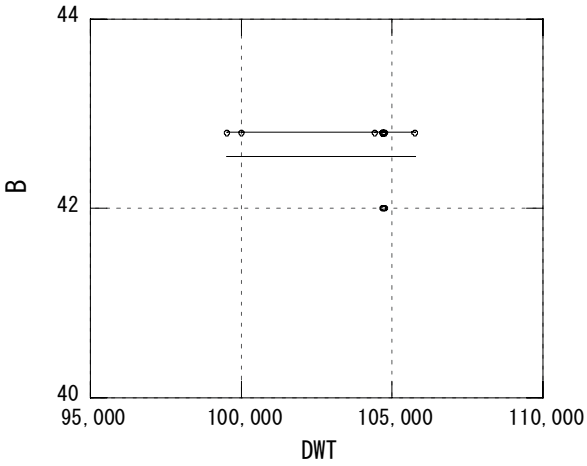



$Y=a_0$

（σ= 1.761 ）

| | Average | 75% |
|---|---|---|
| $a_0$ | 40.4 | 41.6 |

**Figure 3-32** Container Ship
（75,000～Less than 85,000DWT） B-DWT

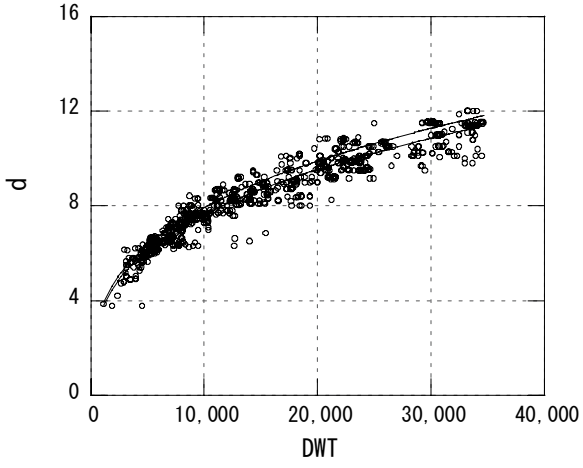



$Y=a_0$

（σ= 0.377 ）

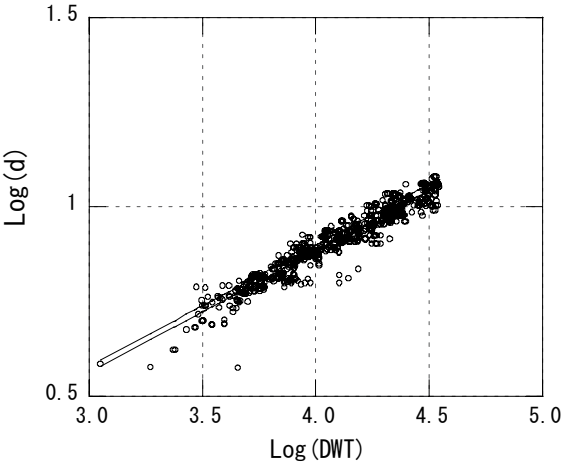
| | Average | 75% |
|---|---|---|
| $a_0$ | 42.6 | 42.8 |

**Figure 3-33** Container Ship
（95,000DWT～） B-DWT




$Y=\alpha \cdot X^{\beta}$

| | 50% | 75% |
|---|---|---|
| α | 0.3991 | 0.4143 |
| β | 0.3202 | 0.3202 |

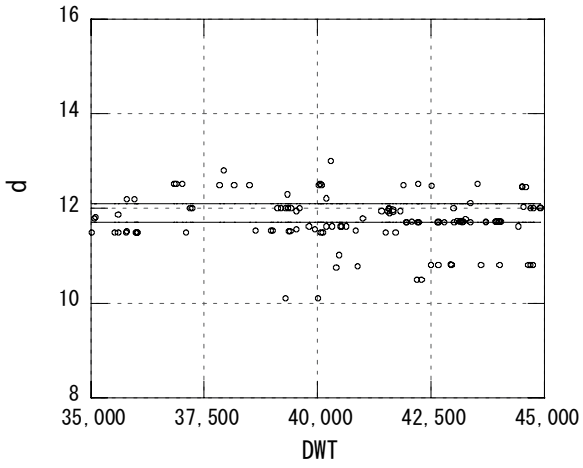



$\log Y=a+b\log X$

( $R^2$= 0.930 , σ= 0.024 )

| | 50% | 75% |
|---|---|---|
| a | -0.3990 | -0.3826 |
| b | 0.3202 | 0.3202 |

**Figure 3-34** Container Ship（～Less than 35,000DWT）d-DWT

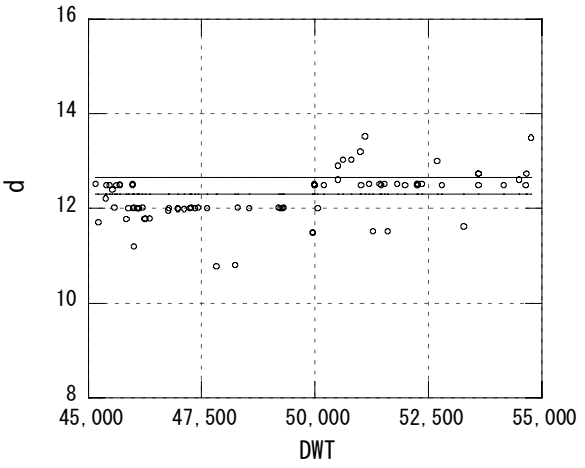



$Y=a_0$

（σ= 0.578 ）

| | Average | 75% |
|---|---|---|
| $a_0$ | 11.7 | 12.1 |

**Figure 3-35** Container Ship
（35,000～Less than 45,000DWT）d-DWT

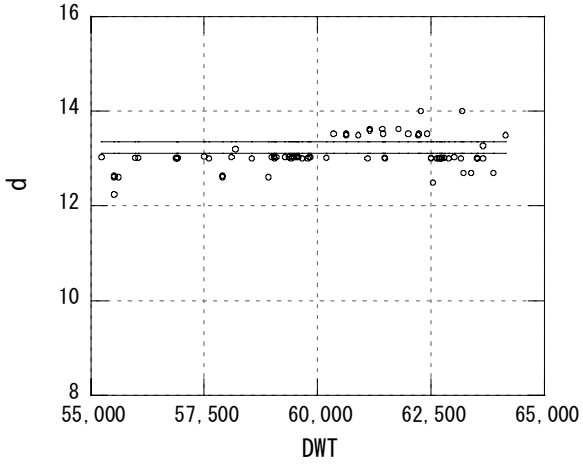



$Y=a_0$

（σ= 0.518 ）

| | Average | 75% |
|---|---|---|
| $a_0$ | 12.3 | 12.7 |

**Figure 3-36** Container Ship
（45,000～Less than 55,000DWT）d-DWT

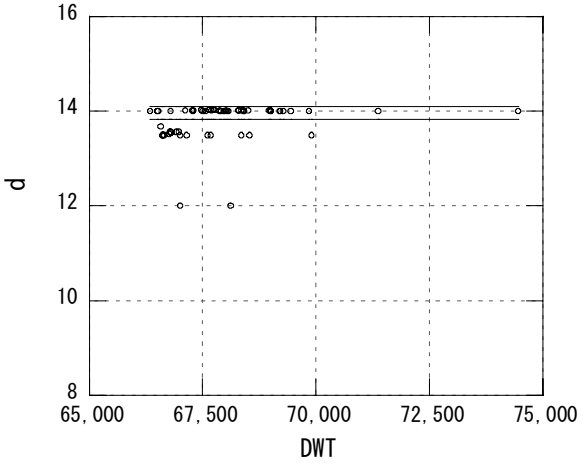



$Y=a_0$

（σ= 0.369 ）

| | Average | 75% |
|---|---|---|
| $a_0$ | 13.1 | 13.4 |

**Figure 3-37** Container Ship
（55,000～Less than 65,000DWT）d-DWT

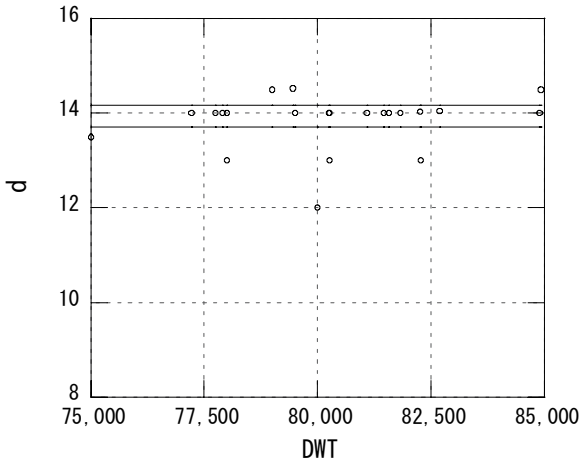



$Y=a_0$

（σ= 0.394 ）

| | Average | 75% |
|---|---|---|
| $a_0$ | 13.8 | 14.1 |

**Figure 3-38** Container Ship
（65,000～Less than 75,000DWT）d-DWT

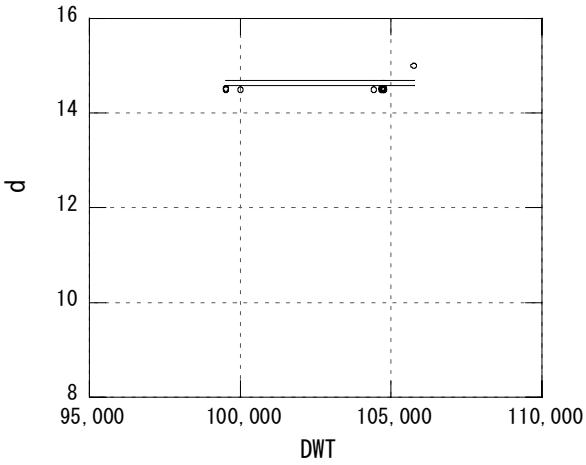



$Y=a_0$

（σ= 0.689 ）

| | Average | 75% |
|---|---|---|
| $a_0$ | 13.7 | 14.2 |

**Figure 3-39** Container Ship
（75,000～Less than 85,000DWT）d-DWT




$Y=a_0$

（σ= 0.174 ）

| | Average | 75% |
|---|---|---|
| $a_0$ | 14.6 | 14.7 |

**Figure 3-40** Container Ship
（95,000DWT～）d-DWT