

Research Trends and Results

Basic Analysis of Energy-saving Domestic Marine Unit Load Transportation

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1. Introduction

Response to global warming has become an important issue, and the need for unit load transportation using containers, chassis, etc. are also great.

In order to contribute to the design of policies for future freight transportation, we conducted a questionnaire survey of shipping companies which operate ferries, RORO ships and container ships used for domestic marine unit load transportation. We also introduce the results of analysis conducted to grasp the state of actual transportation by every ship type and the state of measures taken by shipping companies to reduce energy consumed by transportation.

2. The outline of the questionnaire survey

The questionnaire form related to energy-saving transportation was created separately for ferries, RORO ships, and container ships, and it was mailed to shipping companies in July, 2012.

The recovery results are shown in the table.

Table. Questionnaire vote recovery result

	Total of all ship types		
	Ferry	RORO ship	Container ship
Number of shipping companies (Recovery rate)	29 (94%)	11 (100%)	12 (86%)
Number of ships (Recovery rate)	55 (90%)	22 (100%)	16 (80%)

Note: Because the questionnaire survey of more than one type of ship may have been conducted in the same shipping company, the sum of the number of shipping companies of all ship types and the number of shipping companies of each ship type do not match.

3. Analysis of the questionnaire survey result

(1) Actual state of domestic marine unit load transportation

Based on the questionnaire, the results of analysis of operation speed for every route section, and fuel consumption per distance and per ton-kilometer are shown in figure 1.

Operation speed is shown in the upper row of figure 1. The average value of the operation speed for every route section of ferries was the largest, revealing a characteristic of passenger ferries.

Moreover, all types of ships sailed an average of between 80% and 90% of their service speeds.

Fuel consumption is shown in the lower row of

Figure-1. The average actual fuel consumption per distance differed between ship types, with that of ferries the largest. However the average value of actual fuel consumption per ton-kilometer differed little between ship types.

This is because the load factor of container ships was low and that of ferries was high. So fuel consumption per ton-kilometer of container ships was high.

When the average value of estimated fuel consumption per ton-kilometers when fully loaded was compared with the actual average value, it turned out that the average value of fuel consumption per ton-kilometers of ferries decreases about twenty percent, RORO ships decreases about 60 percent, and container ships decreases about 70 percent.

Operation speed and fuel consumption analysis results

Figure 1. Results of analysis of operation speed and fuel consumption

Ship type (Actual value)	Ferry (Average 5,083t)	RORO ship (Average 5,367t)	Container ship (Average 2,357t)	
Operation speed (Actual value)	Average 37.1 [km/h]	Average 34.6 [km/h]	Average 19.8 [km/h]	
Cruising rate/speed (Actual value)	Average 86.3%	Average 88.5%	Average 85.3%	
Fuel consumption (Actual value)	Per unit distance	Average 67 [kg/km]	Average 44 [kg/km]	Average 15 [kg/km]
	Per ton-kilometer	Average 0.026 [kg/t/km]	Average 0.023 [kg/t/km]	Average 0.023 [kg/t/km]
When fully loaded Fuel consumption (Estimated value)	Per unit distance	Average 0.020 [kg/km]	Average 0.009 [kg/t/km]	Average 0.007 [kg/t/km]
	Per ton-kilometer	Average 0.020 [kg/t/km]	Average 0.009 [kg/t/km]	Average 0.007 [kg/t/km]

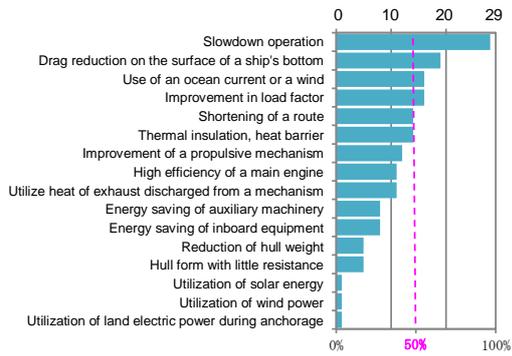
(2) State of measures to save energy in transportation

The questionnaire results are shown in figure-2.

Most shipping companies carried out slowdown operation (97%). Many shipping companies carried out energy-saving transportation measures which do not require much investment in plant and equipment.

The number of shipping companies which carried out each energy-saving transportation measure

Figure 2. Number of shipping companies which took each energy-saving transportation measure



4. Conclusion

I would like to utilize the analysis results as data to analyze the influence which environment and modal shift policies have had on the cost of transport and operation speed of domestic marine ships, etc.

[Source]

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<http://www.nilim.go.jp/lab/bcg/siryou/tnn/tnn0716.htm>