

Research Trends and Results

A study on transport mode choice model of domestic marine unit load transportation in view of countermeasures against global warming

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1. Introduction

Adoption of adequate countermeasures against global warming is an urgent problem. In the context of improvement of emissions trading scheme, and application of the exception of petroleum and coal tax for global warming since last fall, it is also assumed that difference of CO₂ emission among transport modes affects to choice of transportation. We have developed the mode choice model and have analyzed how the choice of transportation will be changed in the future by policy of countermeasures on greenhouse gases reduction and carbon tax considering the difference of CO₂ emission among transport modes.

2. Development of transport mode choice model of unit load transportation

Regarding domestic marine unit load transportation by ferry, RORO ship (a type of ship that has no passengers on it) and container ship, we developed an OD matrix (between 47 prefectures, but Hokkaido is divided into 4, so it has 50 segmentations) that can grasp real departure and arrival place of cargo based on net flow. We also developed an OD matrix of main items of marine unit load which transported by rail or car cargo.

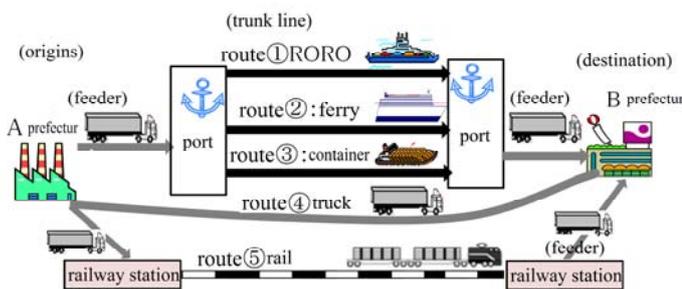


Chart-1 Route of each transport mode (Concept illustration)

And from the OD matrix, about transportation of long distance that exceeds 300km, and medium distance that is between 100km and 300km, the main OD that has large amount of cargo is extracted. Regarding the main transportation of each OD, we estimated parameter which can explain the situation of transport mode (maritime (ferry, RORO ship and container ship), car and rail;

chart-1) choice well, by aggregate logit model which includes transportation cost, transportation time, with or without transshipment, and we developed transport mode choice model.

3. Analysis of choice of transportation by countermeasures against global warming

Based on the transport mode choice model, an analysis was done to see how the transport mode rate changes by the difference of tax amount for carbon price and future change of CO₂ emissions of each transport mode.

As an analysis example, if transportation distance is 500km and carbon tax is 30,000 yen /t-C, we compare transport mode rate of 3 cases. Case A: emission of ferry is same as present situation. Case B: emission of ferry is reduced 20% by technical innovation. Case C: emission is the same as case B and speed of ferry is reduced 20%. In case B, share of car is decreased and share of ferry is increased, but in case C, share of ferry is decreased significantly compared to case A. (chart-2)

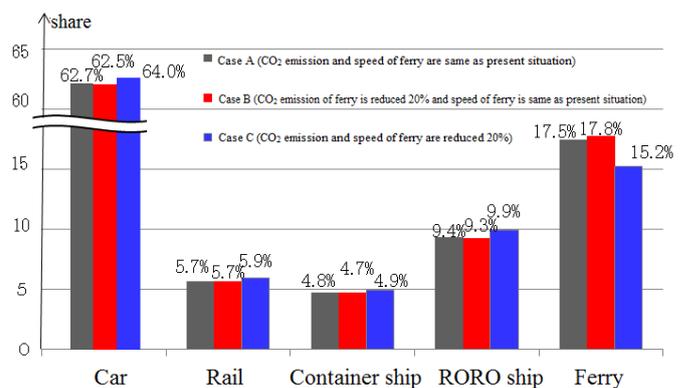


Chart-2 Impact to the transport mode rate by CO₂ emission and speed

4. Conclusion

We will consider differences of CO₂ emission by operational speed, and upgrade transport mode choice model.

Reference

TECHNICAL NOTE of NILIM No.708

<http://www.nilim.go.jp/lab/bcg/siryou/tnn/tnn0708.htm>