

Development of Transportation Route Analysis Tool for Container Cargoes Using the Sacrifice Model

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1. Introduction

When implementing effective measures and efficiently developing ports and harbors in future, it will be vital to conduct quantitative verification and analysis based on various environmental changes surrounding international maritime container distribution both in Japan and abroad (such as the rapid economic growth mainly in Asian countries and the designation of international strategic ports).

This paper summarizes the construction of a model that will make it possible to analyze changes in routes of international maritime container distribution, and associated changes in transportation cost, based on changes in the distribution environment between Japan and principal regions.

2. Outline of the developed model

The model was constructed using the sacrifice model, whereby cargo transportation time is converted to a cash equivalent and the route with the smallest sacrifice volume consisting of the two elements of “time cost” and “transportation cost” (Eq.(1)) is selected.

$$Sr = Cr + Tr \cdot \alpha \dots\dots\dots (1)$$

Sr: total sacrifice volume, Cr: cost, α : time value, Tr: time

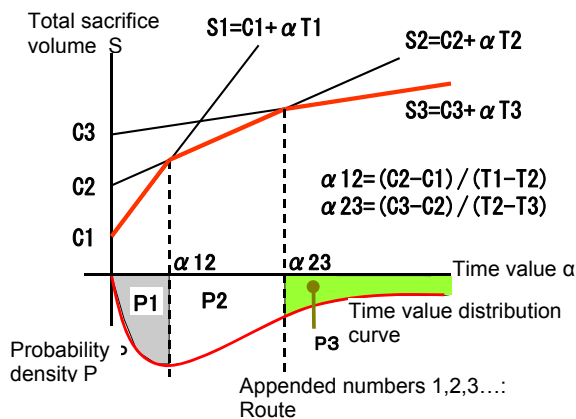


Figure 1. Result of time value estimation (Asian cargoes)

The three straight lines in Fig. 1 show the sacrifice volume for each route expressed in Eq. (1). These show that, when a cargo’s time value changes, the route with the minimum sacrifice volume also changes. When constructing the model, we estimated

the time value distribution so that cargo operators could select a route consistent with actual cargo transportation data that can be ascertained from the Container Cargo Movement Survey (2008, MLIT).

Figure 2 shows the result of a simulation of cargoes handled by different ports based on the estimated time value distribution. Although there is some discrepancy (for example, the simulation for Ise Bay is smaller than the actual value while that for Hanshin Port is larger), the trends in volumes handled are generally well reproduced, including other ports with smaller cargo handling volumes.

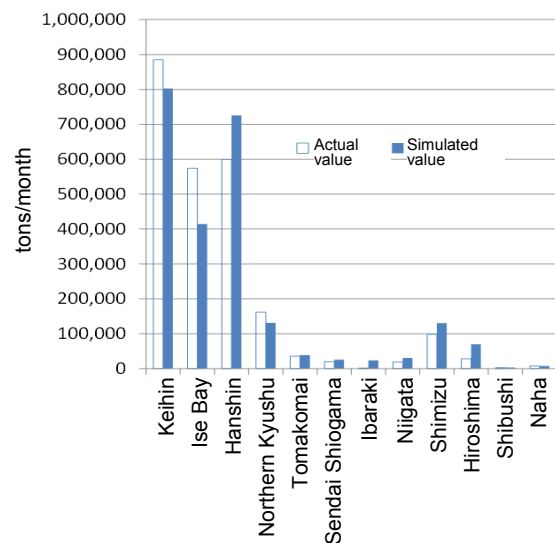


Figure 2. Model simulation values for cargo handling volumes in principal ports

3. Use of the developed model in the Basic Policy on Ports and Harbors

This model was used when estimating container cargo volumes for principal ports in the Sept. 2011 change to the Basic Policy on Ports & Harbors (Notification of the Minister of Land, Infrastructure and Transport), based on the forecast of total cargoes handled by Japanese ports under the import and export cargo estimation model.

[Reference]
 NILIM Technical Note No. 589, 2010