Tramp ship routing and scheduling with integrated bunker optimization

A tramp ship operator typically has some contracted cargoes that must be carried and seeks to maximize prot by carrying optional cargoes. Hence, tramp ships operate much like taxis following available cargoes and not according to a fixed route network and itinerary as liner ships. Marine fuel is referred to as bunker and bunker costs constitute a significant part of the daily operating costs. There can be great variations in bunker prices across bunker ports so it is important to carefully plan bunkering for each ship. As ships operate 24 hours a day, they must refuel during operations. Therefore, route and schedule decisions affect the options for bunkering. Current practice is, however, to separate the two planning problems by first constructing fleet schedules and then plan bunkering for these fixed schedules. In this paper we explore the effects of integrating bunker planning in the routing and scheduling phase and present a mixed integer programming formulation for the integrated problem of optimally routing, scheduling and bunkering a tramp fleet. Aside from the integration of bunker, this model also extends standard tramp formulations by using load dependent costs, speed and bunker consumption. We devise a solution method based on column generation with a dynamic programming algorithm to generate columns. The method is heuristic mainly due to a discretization of the continuous bunker purchase variables. We show that the integrated planning approach can increase prots and that the decision of which cargoes to carry and on which ships is affected by the bunker integration and by changes in the bunker prices.

General information
Publication status: Published
Organisations: Department of Management Engineering, Management Science
Contributors: Vilhelmsen, C., Lusby, R. M., Larsen, J.
Pages: 143-175
Publication date: 2014
Peer-reviewed: Yes

Publication information
Journal: EURO Journal of Transportation and Logistics
Volume: 3
Issue number: 2
ISSN (Print): 2192-4376
Ratings:
BFI (2014): BFI-level 1
Original language: English
Keywords: Tramp Shipping, Routing, Scheduling, Bunkering, Column Generation
Electronic versions:
bunker_paper_postprint.pdf
DOIs:
10.1007/s13676-013-0039-8
Source: dtu
Source-ID: u::7493
Research output: Contribution to journal › Journal article – Annual report year: 2013 › Research › peer-review