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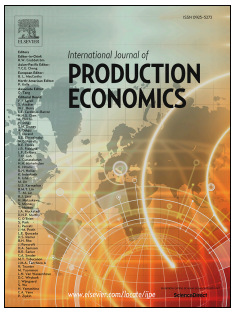

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Tian Liu, Yeming Gong, René B.M. De Koster

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Travel time models for split-platform automated storage and retrieval systems

Tian Liu[a], Yeming Gong[b,*], René B.M. De Koster[c]

[a] *School of Economics and Management, Dongguan University of Technology, Dongguan 523000, PR China*
[b] *EM Lyon Business School, Lyon, France*
[c] *Rotterdam School of Management, Erasmus University, Burgemeester Oudlaan 50, 3062 PA, Rotterdam, The Netherlands*

Abstract

In traditional automated storage and retrieval (AS/R) systems, the storage and retrieval machine travels simultaneously in the horizontal and vertical directions. The so-called split-platform AS/R (or SP-AS/R) system consists of platforms (or shuttles and lifts), that can move independently in horizontal (shuttles) and vertical (lifts) directions. This paper studies two dual command travel time models for such systems. We formulate a continuous travel time model for an SP-AS/R system with a dedicated lift per rack and another travel time model for an SP-AS/R system with a dedicated lift per job type. Then we analyse the performance of these two models. The two models are validated by computer simulation and appear to give quite accurate results. We show that the optimal cycle time gap with the upper bound derived by an existing literature can be as large as 26%. We find interesting management insights for system implementation: when the shape factor of the rack is approximately less than 1, the policy using a dedicated lift per rack is better; when the shape factor of the rack is approximately more than 1, the policy using a dedicated lift per job type outperforms.

Keywords: warehousing, autonomous vehicle storage and retrieval systems, travel-time models, optimization, performance evaluation

*Corresponding author
Email addresses: liutian@dgut.edu.cn (Tian Liu), GONG@em-lyon.com (Yeming Gong), rkoster@rsm.nl (René B.M. De Koster)