

An optimization model for integrated vehicle routing problem and vehicle sequencing problem with Cross-docking System

Gnanapragasam S.R.^{1,2*} and Daundasekera W.B.³

¹*Department of Mathematics, The Open University of Sri Lanka, Nawala, Nugegoda, Sri Lanka*

²*Postgraduate Institute of Science, University of Peradeniya, Peradeniya, Sri Lanka*

³*Department of Mathematics, University of Peradeniya, Peradeniya, Sri Lanka*

The efficiency of a supply chain (SC) is crucial for survival in the globalized industrial environment. Industries adopt the innovative logistic strategy known as “Cross-docking” in their SC to satisfy the requirements of customers in terms of time, quality, and cost. A cross-docking system (CDS) operates as a transshipment center between suppliers and customers. As per the recommendations made in the literature on SC, this study integrates the vehicle routing problem and vehicle sequencing problem with some internal operations such as loading/unloading products at the doors of CDS and moving shipments inside the CDS. Therefore, the objective of this study is to obtain the optimal solution to the integrated problem of “routing vehicles from CDS to suppliers and from CDS to customers” and “sequencing inbound vehicles to single in-door and outbound vehicles to single out-door at CDS” which is referred here as VRSQ-CDS. Sequencing the inbound vehicles to in-door is based on the arrival time to CDS and the outbound vehicles are sequenced based on the product ready time at CDS. The results of the small-size instances extracted from a benchmark problem are compared with the enumeration method to ensure accuracy. Furthermore, the compatibility of the developed mixed integer quadratic programming model for VRSQ-CDS is also confirmed in it. Therefore, it is recommended to employ this model in small-size instances. Since the run time to obtain the exact solutions gradually increases with the problem size when using the Branch and Bound algorithm, it can be recommended to apply an appropriate meta-heuristic approach to reach a near-optimal solution to large-size instances of VRSQ-CDS.

Keywords: Cross-docking, Moving shipments, Optimization, Routing problem, Sequencing Problem

*Corresponding author: srgna@ou.ac.lk