

# **A Polynomial Time Tour Algorithm for Order Picking Operations in Warehouses and New Aisle Designs**

**Ömer Öztürkoğlu**

Department of Business Administration  
Yasar University  
Izmir, 35100, TURKEY  
[omer.ozturkoglu@yasar.edu.tr](mailto:omer.ozturkoglu@yasar.edu.tr)

**Deniz Hoşer**

Department of Industrial Engineering  
Yasar University  
Izmir, 35100, TURKEY  
deniz.hoser@gmail.com

## **Abstract**

In this paper, we aim to develop a new innovative warehouse design that provides savings for order picking operation which is the most costly and the most related operations with the order delivery time in warehouses. For this purpose, we propose a Discrete Cross Aisle Warehouse Design layout as an alternative to traditional 2-block warehouse layout. In this proposed layout, linear middle cross aisle is designed as a discrete structure (one tunnel on each pick aisle). Harmony search algorithm is used to find an optimal tunnel positions that minimize the average tour length under randomized storage policy by searching the space of all possible designs. In order to calculate average tour length on a proposed design, an algorithm that solves order picking problem optimally in polynomial time is presented. Computational experiments show that optimum designs have the same layout with the traditional 2-block design for small size order lists. As the number of locations to be visited increases, we propose new tunnel allocations that present up to 5% less travel than that in 2-block traditional layout.

Warehouse design, order picking, tour algorithm, and randomized storage

## **Keywords**

Order picking, warehouse design, tour algorithm, randomized storage, aisle design.

## **Acknowledgements**

This work was supported by the Scientific and Technological Research Council of Turkey (TÜBİTAK), Grant No: 214M220.

## **Biography**

**Ömer Öztürkoğlu** is an Assistant Professor in Business Administration at Yasar University, Izmir, Turkey. After completing his undergraduate studies at the Department of Industrial Engineering in Dokuz Eylül University, Turkey, he completed his Master studies at Erciyes University from the Industrial Engineering Department in Turkey. Next, he completed his master and doctoral studies in Industrial and Systems Engineering at Auburn University, Alabama, USA. He teaches related courses to Logistics Facilities, Warehousing, and Production and Operations Analysis. In general, his research interests are warehousing, production and operations systems analysis and design.

**Deniz Hoşer** is a master student in Department of Industrial Engineering at Yasar University, Turkey. She earned her BSc. Degree in industrial Engineering at the same university with an honorary degree. She has been working on a warehouse design in her thesis.