Development of Design Algorithm for Delivery Center
(Prof. J. Ota)

Delivery centers are facilities for making shipment of many kinds of products from factories to commission agents or retail shops. In this research, we deal with a design problem of material flow in the delivery center. The problem can be expressed as follows: determining the sizes of the automatic warehouses, the number of warehouse cranes, that of depalletizers and robots, and the flow volume among these equipments.

An overview of a delivery center, and design objects are shown in Fig.1. In recent years, some delivery centers have been completely automated to improve the operational costs and shipping efficiency.

We propose an extended network flow model in which each device represents a node of the network flow and the conveyed products correspond to the flow within the model. Figure 2, 3 represent the proposed model. When designing a delivery center, it is necessary to determine the appropriate number of devices, the flow among the devices, device-layout, etc. while holding the costs down and satisfying the demand throughput. In the proposed network flow model, several binding clauses exist between nodes and arcs. These clauses are represented as linear constraints. Under these constraints, the number of machines and the flow volume should be optimized. This problem is formulated as a mixed integer problem.

To validate the effectiveness of the proposed model and algorithm, we designed a delivery center using actual shipping data. The result shows that our proposed method can get feasible design results within a few minutes.

Keywords: Warehouse management, Material flow, Logistics

References

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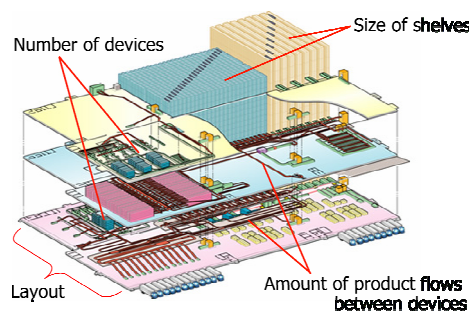

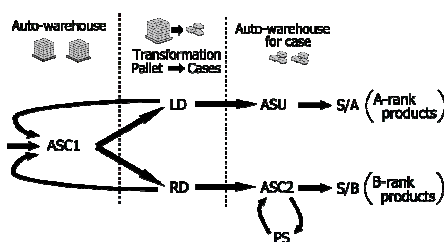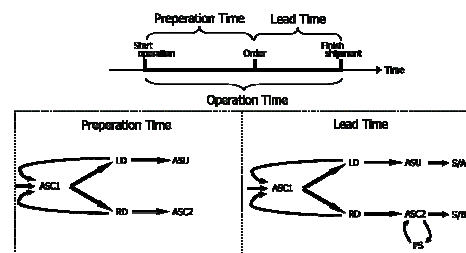Fig. 1 Warehouse design object(Firure taken from the website of Murata Macninery, LTD. http://www.muratec-l-system.com/en/)

Fig. 2 Network-flow model

Fig. 3 Operation time and lead time