CHAPTER 6

CONCLUSIONS AND RECOMMENDATIONS

6.1 Conclusions

Based on this study presented in the previous chapters the following conclusions are drawn:

This thesis objectives are to control inventory by considering on group ordering policy to meet suitable inventory quantity and level and to develop a heuristic truck loading algorithm that properly utilizes truck loading capacity for lower transportation cost.

Inventory control and transportation of actual system are managed by past experiences. The distributor does not have a system or theory to manage. In addition, it has only one clerk to count items and calculate order quantities. If this person is not available, it is difficult to find person to replace on this duty. (s, S) min-max inventory management system and heuristic truck loading algorithm are proposed as a systematic operation.

Group ordering inventory management system starts with data collection. Product information, demand (sales), and available of stock level are collected from construction materials' distributor. A wide variety of construction materials is grouped for ordering by supplier. The items that manufactured from the same supplier are one group ordering. There are 13 product groups of 3 main suppliers including 3 major suppliers, 8 minor suppliers, and 2 miscellaneous suppliers. Two product groups of major suppliers: Siam fiber-cement group and Siam gypsum industry group are selected and studied an inventory management system and truck loading algorithm. These two product groups are major products that have frequency of daily transaction of sales data that are greater than other products of minor and miscellaneous suppliers. They also have the costs of transportation to study a truck loading algorithm.

The (s, S) system that is referred to a min-max system is used in inventory management. The system involves continuous review and demands are assumed as deterministic and static. Whenever the inventory position drops to the order point (minimum) s, a replenishment quantity (EOQ) is placed of sufficient magnitude to raise the position to the order-up-to-level (maximum) S. This is a simple sequential determination. It starts from calculating the EOQ then specifies safety factor to calculate the order point (s) and order-up-to-level (S). Each item in each product group has three values: order point (s), order-up-to-level (S), and order quantity (EOQ).

After the three values of inventory system of each item in two product groups have already been defined, a heuristic truck loading algorithm is studied by using the data of month March, April, May including demand, on hand inventory, on order, replenishment inventory, and inventory position data. A heuristic truck loading algorithm that is closely related to the practical situation is studied to select the items within the same product group for ordering. One purchase order has to be included two or more items. When any item drops to order point, it is ordered by order quantity (EOQ). Other items are considered by Ratio To Order (RTO). 10-wheel truck and maximum loading capacity are defined.

After a heuristic truck loading algorithm is studied like a simulation in three months, the inventory positions of two product groups have been changed between actual and proposed system. Holding cost in three months of Siam fiber-cement group is increased 1,692.22 baht or 0.43 per cent and holding cost in three months of Siam gypsum industry group is increased 791.90 baht or 1.12 per cent. Holding cost in three months of two product groups is increased 2,484.12 baht or 0.54 per cent in comparison with holding cost of actual system. Holding cost of two product groups of proposed system is higher than actual system because algorithm of truck loading has to consider the items followed by the Ratio To Order (RTO) for loading into 10-wheel truck. On the other hand, holding costs of actual system can be higher than a proposed system because an increasing a number of orders for transportation leading to higher stocks.

A number of trips of transportation of proposed system are reduced. It means transportation cost of heuristic truck loading algorithm can save against the actual system. Transportation cost in three months of Siam fiber-cement group is reduced 2,020.46 baht or 20.57 per cent and transportation cost of Siam gypsum industry group is reduced 856.96 baht or 24.79 per cent. Transportation cost in three months of two product groups is reduced with cost savings of 2,877.42 baht or 21.67 per cent.

Total cost in three months of Siam fiber-cement group is reduced 328.24 baht or 0.08 per cent and total cost in three months of Siam gypsum industry group is reduced 65.06 baht or 0.09 per cent. Total cost in three months of two product groups of proposed system is reduced only 393.30 baht or 0.08 per cent because of higher holding cost of proposed system in comparison with an actual system. Even though total cost of proposed system can save a few cost, systematic operation of min-max inventory system and heuristic truck loading algorithm is proposed instead of human assistance who uses experiences in inventory control and transportation.

The procedures of systematic operation are described as follows: (after values of (s, S) system of each item have been calculated already).

1. Each item in each product group has to be checked inventory level everyday as a continuous review.

2. Whenever the inventory position (on hand plus on order) of any item drops to the order point (minimum) s, the order quantity (EOQ) is placed. The order-up-to-level is a maximum level of an item.

3. Total weight of ordered items is calculated. Maximum loading capacity of 10-wheel truck defined is 13 tons.

4. If capacity of truck loading is available, other items that are not ordered will be considered by Ratio To Order (RTO).

5. RTO calculation is (inventory position – minimum) / (maximum – minimum).

6. If an item has lower RTO than other items, it is the first priority ordered. The order quantity is equal to maximum level minus inventory position. It means that order quantity of item must not exceed the order-up-to-level (maximum) of that item.

7. Other items are considered by RTO and loaded into truck that must not exceed a maximum loading capacity.

8. If RTO if an item is equal to another item, one item is chosen and ordered that is equal to maximum level minus inventory position.

9. The items that are ordered must come from the same product group. It means that ordered items are manufactured from the same supplier.

10. Finally, a purchase order is issued. The ordered items are transported from the manufacturing plant to the distributor.

In addition, according to (s, S) system and truck loading algorithm, it can keep in sufficient quantity for customer demands. At the same time, inventory turnover is tested to measure inventory performance. Inventory turnover of two product groups of proposed system is decreased. It means that inventory performance is reduced due to higher value of average inventory level of proposed system from heuristic truck loading algorithm.

Due to a heuristic truck loading algorithm studied, holding cost of proposed system is higher than actual system. Sensitivity analysis of interest rate (14% and 10%) is tested. The inventory system and heuristic truck loading algorithm are sensitive to the change of decrement interest rate parameter. The percentages of increased cost of holding cost in three months are decreased when interests rates are decreased. The percentages of reduced cost of total cost in three months are increased in comparison with actual system when interest rates are decreased.

So the input parameter should be revised whenever there is change such as in interest rate of interest on capital of inventory holding cost.

6.2 Recommendations for further study

For the system to be more useful, the following recommendations may prove beneficial.

1. According to the background of construction materials' distributor, the company is family business. Decisions are made by past experiences. Data in the company are not kept appropriately. The system will be more efficient if the exact transaction sizes and times are noted. A computer assistance that is continuous monitoring can be used in the data collection, managed inventory system, and calculated order quantities and total weights of 10-wheel truck for heuristic truck loading algorithm.

2. For items that used the simple sequential determination (s, S) system, it may cause to less saving total cot of proposed system. According to Kunraksa C. (1998), the study proposes a new approach to calculate the parameters in the model. It determines the order quantity (EOQ) and the safety factor simultaneously and then calculates the order point (s) and order-up-to-level (S) respectively. The model gives better solutions because the simple sequential method gives no direct consideration to the shortage cost. And, this new approach can have a result of higher saving total cost. Further studies could be made by this new approach.

3. This study assumes that the demands are deterministic and static. Further studies could be made for the dynamic and stochastic demand.

4. A coordinated replenishment inventory control model where the coordination of replenishment orders for selected groups of items can be studied. The procedure for selecting the order-up-to-levels, can-order-points, and must-order points of a coordinated control system is used. This model is appropriate for cases where there are a variety of suppliers and a large number of items supplied.

5. Truck loading algorithm is considered only weight of truck. Further studies could be made by volume of truck.

6. The proposed system: (s, S) inventory management system and heuristic truck loading algorithm can be applied for other distributors that have to consider a group of products and truck loading capacity. In addition, if any business has transportation cost that is much more than inventory holding cost, it can be applied by heuristic truck loading algorithm for purpose of cost reduction.