

## MODELING THE DEVELOPMENT OF A MATERIAL STORAGE WAREHOUSE FOR WASTE SORTING PLANTS

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### Abstract

Currently, the waste situation of Udon Thani Municipality has an average of 162.46 tons of waste per day that needs to be disposed of. Of this, fresh waste each day consists of 53.74 percent food waste, 23.40 percent plastic, 11.52 percent paper, 6.91 percent bottles and glasses, 1.11 percent metal, and 3.32 percent others. In addition, it must also receive waste from 40 nearby local administrative organizations, totaling 149.26 tons per day. When waste is brought into the project, the remaining waste from sorting will not exceed 20 percent of the total amount of waste. 1 Survey and inspection of problems in the store The following problems were found: 1) Equipment is not organized 2) No storage for equipment 3) No space allocation in the store From the problems found, the problem of no space allocation in the store was selected to analyze the cause and find a solution. Because the lack of space allocation in the store will result in the available space not being used to its full potential. 2 Solve the problem of space management, storage of tools and others in the store In this project study, the project developer surveyed the problems in the store using the fishbone diagram tool and found the cause of the problem using the Why Why Analysis tool. The results of the analysis were used to solve the problem as follows: 1. Create a tool storage device (Shelving) to place tools and products used in the work to solve the problem of unorganized product placement. 2. The work manual (Work Manual) is a manual that helps reduce duplicate work and reduce errors in the work. 3. Warehouse design (zoning) makes it convenient to pick up tools. 4. Storage system by specifying the location (Location) by numbers helps reduce the time spent finding tools.

**Keywords:** Warehouse, Development, Location

### Introduction

Currently, the waste situation of Udon Thani Municipality has an average of 162.46 tons of waste per day. Of the daily fresh waste, it consists of 53.74 percent food waste, 23.40 percent plastic, 11.52 percent paper, 6.91 percent bottles and glasses, 1.11 percent metal, and 3.32 percent others. In addition, it must also receive waste from 40 nearby local administrative organizations, totaling 149.26 tons per day. When waste is brought to the project, the remaining waste from sorting will not exceed 20 percent of the total amount of waste. The waste-to-energy power plant can handle up to 600 tons of waste per day, divided into two sets, each able to process 300 tons of waste per day. One of the two sets is designed to handle both fresh waste and old waste from landfills. The advantage of designing these two sets of separation systems is that they help make the system stable and can operate all year round. Even if one set is stopped for maintenance, the other can still handle 300 tons of waste per day.

1. Survey and solve problems in the store and solve problems in space management, storage of work tools, etc. in the store. The store supervisor and the manager of the waste

separation plant were interviewed about the problems in the store and the problems in store management. What are the problems? Recording

2. Problems found from the survey from the field visit, the project organizer found the following problems:

- 2.1 Equipment is not organized
- 2.2 No place to store equipment
- 2.3 No space allocation in the store

From the problems found, the project organizer selected the problem of no space allocation in the store to analyze the cause and find a solution. Because no space allocation in the store will result in the available space not being used to its full potential

3. Steps for using tools to analyze the cause of the problem

- Fishbone Diagram
- Why why analysis diagram
- Work Manual

### **Research Objectives**

1. Investigate and inspect problems within the store
2. Solve problems in managing the storage area of work tools and others within the store

### **Scope of the Research**

1. Population Scope Waste sorting plant, Udon Thani Province
2. Variable Scope It increases employee performance and reduces non-value-added steps in the work process, while also providing a more efficient work approach.
3. Time Scope January 2023 to April 2024

### **Research Methodology**

1. Research Methodology Create a model of store management of a waste separation business, a case study of a waste separation factory business in Udon Thani Province, to survey and inspect problems within the store and solve problems of space management, storage of work tools and others within the store of the waste separation factory business in Udon Thani Province, to be efficient by using a warehouse management system (Warehouse Management) and a manual system (Manual System).

2. Research Steps

2.1 Steps of the field study of the current working conditions

To survey and examine problems within the store and solve problems of space management, storage of work tools, etc. within the store. The store supervisor and the manager of the waste separation plant in Udon Thani Province were interviewed about the problems in the store and the problems in store management. What are the problems? By recording

2.2 Problems found from the field survey The project organizer found the following problems:

- 1) Equipment is not organized
- 2) No place to store equipment
- 3) No space allocation in the store

From the problems found, the problem of no space allocation in the store was selected to analyze the cause and find a solution. Because the lack of space allocation in the store will result in the available space not being used to its full potential

Steps of using tools to analyze the cause of the problem

### 3. Data Collection Steps for using tools to analyze the cause of the problem

Fishbone Diagram

Why why analysis diagram

Work Manual

### 4. Data Analysis

Using the Fishbone Diagram to analyze the problem Due to the insufficient and unorganized space for storing tools and equipment, it is necessary to manage the storage area for tools and equipment by separating them so that the equipment and tools are not mixed together, which makes it easier to pick up tools and equipment. Therefore, the Fishbone Diagram or Cause Diagram is used, which is an appropriate tool for analyzing the problem. The researcher will use the Fishbone Diagram to show all the problems that cause problems in managing limited space, which can analyze the causes of the problem before improving it. The analysis of the Fishbone Diagram is divided into 4 factors as follows:

1) Human factors, with sub-topics as follows: No zoning for placement, Cannot find spare parts, Incorrect disbursement, Not following the process, Storage according to available space.

Therefore, the topic of Cannot find spare parts was selected to find the cause of the problem.

2) Method factors, with sub-topics as follows: Loose methods, Too many steps in the work sequence, Unclear location indication method, therefore, the topic of Unclear location indication method was selected to find the cause of the problem.

3) Machinery factors, with sub-topics as follows: Fire extinguisher not installed, Spare parts Unable to place, no door to close or open, no systematic division of space, equipment not suitable for the parts placed, so choose the topic of equipment not suitable for the parts placed to find the cause of the problem. 4) Raw material factors have sub-topic as follows: not in stock but used immediately, dirty used tools, parts cannot be placed together, similar parts, parts cannot be placed in storage equipment, so choose the topic of similar parts to find the cause of the problem.

Using the Why Why Analysis diagram to find the cause of the problem Because the storage area for tools and equipment does not have enough space and is not organized, it is necessary to manage the storage area for tools and equipment by separating them so that the equipment and tools are not mixed together, which makes it easier to pick up tools and equipment. Therefore, the researcher has used the Why Why Analysis diagram, which is an appropriate tool to find the cause of the problem. The researcher will use the Why Why Analysis diagram to show all the causes that cause the problem of limited space management, which can analyze the cause of the problem before improving it. From the fishbone diagram analysis, the selected data is analyzed. Why Why analysis is divided into 4 factors as follows: 1) Human factors Select the topic of Cannot find spare parts, which is divided into sub-topics as follows: Mixed, No zoning for placement, Zone not specified. 2) Method factors Select the topic of unclear location methods, which is divided into sub-topics as follows: Method not comprehensive, No location specified, Create a more comprehensive work method. 3) Machinery factors Select the topic of equipment not suitable for the spare parts placed, which is divided into sub-topics as follows: Wrong type of use, Insufficient equipment for use, Equipment not prepared. 4) Raw material factors Select the topic of similar spare parts. Which is divided into sub-headings as follows: similar appearance, similar functions, no separate usage types, no specified location.

## Research Results

### 1. Correction and Improvement Process Work Manual

Receipt Report is a document prepared by the buyer after receiving the goods from the seller. The buyer must count the goods together with the invoice sent by the seller to see if they are correct and in accordance with the order. If correct, prepare a receipt and send it to the seller.

1) Put the serial number on the top right of the paper. In case more than 10 types of goods are received, more than 1 document is required, for example, document sheet 1 put number 1, document sheet 2 put number 2.

2) Fill in the information specified in the form above completely.

3) Check the actual condition of the goods and specify in the box whether the goods are complete or damaged.

4) Sign the recipient, sender, and inspector every time.

2. Filing system documents are the process of organizing documents used in the office into a system, from production, use, storage, retrieval, and disposal, whether they are internal or external documents. There is a process for managing documents, along with the use of various technologies to provide services in various areas related to documents within the office efficiently.

1) Store the goods only at the location specified in the document. The first letter is the zone, the second and third letters are the type, the fourth and fifth letters are the floor, and the seventh letter is the row. The example is in the red square.

3. The goods count sheet (Receipt) is a goods count that receives a document to check the goods in the warehouse and storage to know the remaining stock. When the goods count is recorded, the goods count document will be used to record and check the goods count to compare with the actual remaining stock in the program again.

1) Enter the serial number on the top right of the paper. In case the products in each day exceed the count, more than 1 document is required, for example, document sheet 1 enter number 1, document sheet 2 enter number 2.

2) Fill in the information specified in the form completely.

3) Check each location and count the number of products in the rack.

4. The form for withdrawing - paying - returning equipment in the store room is a document that records the withdrawing, paying and returning of items in the store room. Recording the receipt of materials in the material account uses a reference document according to the equipment inspection sheet, which will specify the materials received completely.

1) Enter the serial number on the top right of the paper. In case the equipment in each day exceeds the amount of withdrawal-payment or return and requires more than 1 document, for example, document sheet 1 enter number 1, document sheet 2 enter number 2.

2) Fill in the information specified in the form completely.

3) Fill in the type of product to be withdrawn or returned as desired.

4) Sign every time you come to withdraw or return (when receiving the product, sign every time you come to withdraw or return).

5) The head of the employee, manager, and store room staff must sign every time before withdrawing.

6) In the case of requesting a PPE set, a professional safety officer must consider the payment and sign.

5. The Stock Card is a record of the history of product movement, whether it is buying, selling, or transferring products to various warehouses, which will show how the product has

moved and where it is currently left and how much. Many companies need to use it as evidence to show the Revenue Department.

- 1) Fill in the information specified in the form completely.
- 2) The stock card will ask you to fill in the name of each type of product (each type cannot use the same card).

- 3) Check the list of products and fill in the form.

- 4) It is a document used to record at the work site.

6. List of personal protective equipment is a list of equipment for workers to wear while working to prevent dangers that may occur due to the working conditions and environment. The use of personal protective equipment is one of many methods to prevent dangers from work. Generally, it is based on the principle of prevention and requires the professional to sign to request disbursement only.

- 1) Record the number of equipment that each department employee has withdrawn into each product category column on the date specified on each sheet. Each sheet will have the date already specified.

- 2) Specify the amount of inventory in the Total before disbursement column.

\*Each sheet has a formula already linked. When the disbursement amount is recorded in each product category column, the remaining balance will be automatically calculated.

\*\*When the disbursement amount is recorded each day, the total will be displayed on sheets 1-5, showing a graph summarizing the total disbursement amount and the disbursement amount of each department.

7. Office equipment list: The document list is a record of the disbursement of office equipment documents that are important for the office and the organization to use to help employees conveniently perform their duties, save labor, and work efficiently.

- 1) Record the number of equipment that each department employee has withdrawn into each product category column on the date specified on each sheet. Each sheet will have the date already specified.

- 2) Specify the amount of inventory in the Total before disbursement column.

\*Each sheet has a formula already linked. When the disbursement amount is recorded in each product category column, the remaining balance will be automatically calculated.

\*\*When the disbursement amount is recorded each day, the total will be displayed on sheets 1-5, showing a graph summarizing the total disbursement amount and the disbursement amount of each department.

8. List of equipment is a list of documents for disbursement of equipment invented or created by humans for convenience, speed, saving time and labor. The tools used in various types of work, whether maintenance, installation, repair, modification or production, mostly use measuring tools, cutting, hammering, drilling, planing, welding.

- 1) Record the number of equipment that the technician department staff withdraws in the product column Each type

- 2) Specify the date each time the equipment withdrawal-payment is recorded

- 3) Specify the amount of inventory in the Total before disbursement column

\*Each sheet has a formula already linked. When the withdrawal and payment amount is recorded in the product column of each type, the remaining balance will be automatically calculated.

## Discussion

### Warehouse Design (Zoning)

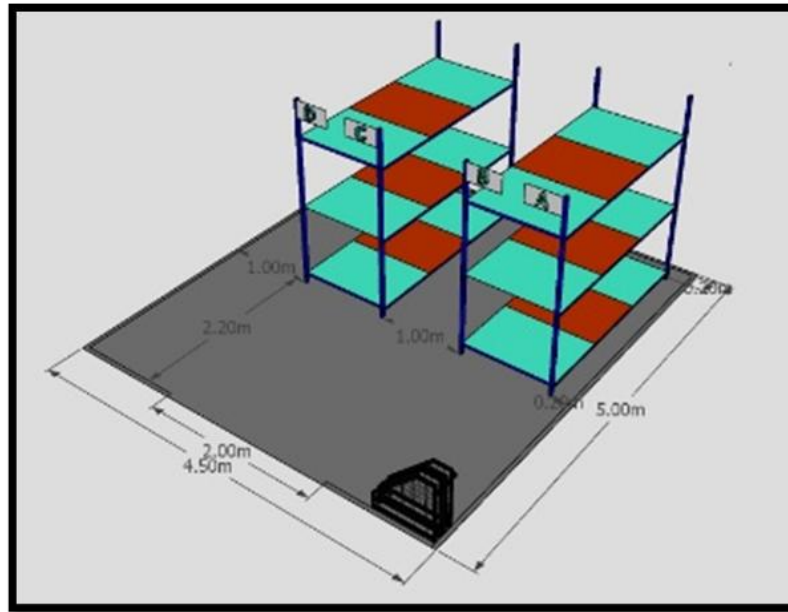


Figure 1: shows the zoning

In the design of the zoning in the store room, the size is equal to width 4.50 meters, length 5 meters, height 2.50 meters. In this design, the I-shaped concept is used, with the racks placed vertically. The racks use 2 racks. The size of the racks is 2.20 meters high, 2.40 meters long, 1.04 meters wide, 0.8 meters high between the channels, and the walkway size is 1 meter. In 1 Racking, it is divided into 3 floors, 2 zones, 3 channels for storing tools, as shown in Figure 2.

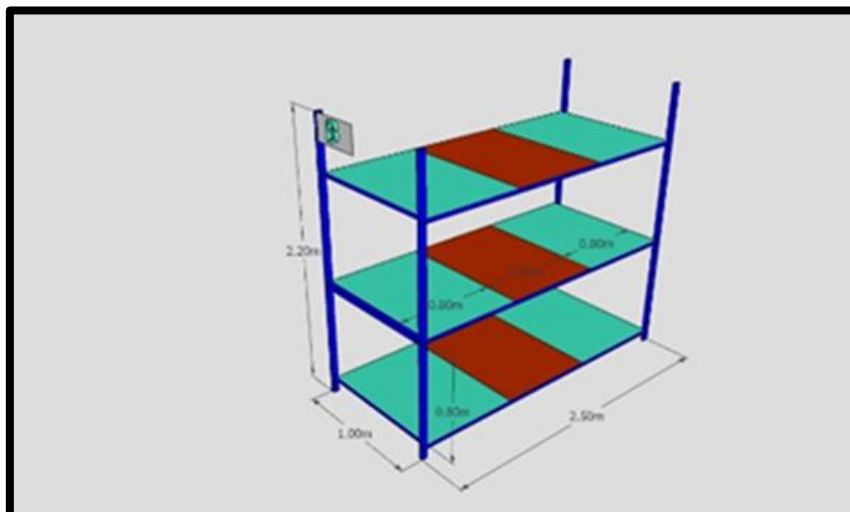


Figure 2: shows Racking

Our zoning is divided into 4 zones: A B C D. Racking 1 consists of Zone A and Zone B. Racking 2 consists of Zone C and Zone D. In 1 Racking, there are 3 levels and 3 rows for storing tools.

### Storage system by specifying location by number

Location Tag				Store : CLS01				Location Tag				Store : CLS01				Location Tag				Store : CLS01							
A	01	01	01	A	01	01	02	A	01	01	03	A	01	01	03	A	01	01	03	A	01	01	03	A	01	01	03
Zone	Type	Floor	Row	Zone	Type	Floor	Row	Zone	Type	Floor	Row	Zone	Type	Floor	Row	Zone	Type	Floor	Row	Zone	Type	Floor	Row	Zone	Type	Floor	Row
Last Update : 01/03/2563				Last Update : 01/03/2563				Last Update : 01/03/2563				Last Update : 01/03/2563				Last Update : 01/03/2563											

Location Tag				Store : CLS02				Location Tag				Store : CLS02				Location Tag				Store : CLS02							
A	01	02	01	A	01	02	02	A	01	02	03	A	01	02	03	A	01	02	03	A	01	02	03	A	01	02	03
Zone	Type	Floor	Row	Zone	Type	Floor	Row	Zone	Type	Floor	Row	Zone	Type	Floor	Row	Zone	Type	Floor	Row	Zone	Type	Floor	Row	Zone	Type	Floor	Row
Last Update : 01/03/2563				Last Update : 01/03/2563				Last Update : 01/03/2563				Last Update : 01/03/2563				Last Update : 01/03/2563											

Location Tag				Store : CLS03				Location Tag				Store : CLS03				Location Tag				Store : CLS03							
A	01	03	01	A	01	03	02	A	01	03	03	A	01	03	03	A	01	03	03	A	01	03	03	A	01	03	03
Zone	Type	Floor	Row	Zone	Type	Floor	Row	Zone	Type	Floor	Row	Zone	Type	Floor	Row	Zone	Type	Floor	Row	Zone	Type	Floor	Row	Zone	Type	Floor	Row
Last Update : 01/03/2563				Last Update : 01/03/2563				Last Update : 01/03/2563				Last Update : 01/03/2563				Last Update : 01/03/2563											

Figure 3: shows the storage system by specifying the location by number

In creating the location by number, it is divided into 4 zones: A B C D. Zone A is divided into 9 channels for storing products.

- The first symbol is zone (A).
- The second and third symbols are the product type.
- The fourth and fifth symbols are the shelf.
- The sixth and seventh symbols are the row.

\* Note: All 4 zones are the same.

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