

# **Designing Warehouse Layout of LCL to Improve Time Efficiency and Space Utilization: The Case of Sonic Interfreight Co., Ltd.**

by

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## **Abstract**

As a part of supply chain warehouse has been played a major role in the flow of cargo across the globe. Moreover, good warehouse management is important to company because effective warehouse will help company to reduce operation time and labor cost. As the case of Sonic Interfreight Co., Ltd who provides the service of LCL ocean freight, the problem is in the process of unloading/loading, space utility, and putting away process. To optimize warehouse time efficiency and space utilization, researchers conducted the study by identifying the operation and warehouse layout, studying the layout of warehouse appropriate for the activities to increase the efficiency of work, and studying to improving the positioning of storage product, layout of warehouse. To reduce the operating time and time to drive forklift into picking product. Researchers collect data by interview employee in office work related document in warehouse and employee work in warehouse, as well as secondary data all of last year. Moreover, identifying by work place observation before analysis of the data obtained from the study and find defect by showing the empirical calculation and find correct solutions. As the result researchers found problems such as lack of space for the demand, cross path, and using loading ramp. After analysis collected data to point out the significant problem. Researchers also suggest some solutions, install pallet rack with two option1 and option2 which in create the capacity of warehouse 463 pallets and 103 pallets respectively, new warehouse layout with two doors, and Build loading dock which reduce the time 32.68 seconds per loading or approximately 6 hours per month. As the result, company can defy the problem that their warehouse is facing which some of the problem are difficult see without research study and data analysis. Furthermore, it is not only benefit to company that is in the case in the case study but also other related business can also consider as the typical problem that most of LCL warehouses have.

**Keywords:** LCL, Loading Ramp, Warehouse, and Space Utilization

## **1. Introduction**

Nowadays, more and more cargo is being transported across the globe. In order to facilitate the flow of cargo, supply chain has been created and developed remarkably. As a part of supply chain warehouse has played a major role in the flow.

Good warehouse management is important to company because it will help company to reduce operation time and labor cost (Manhattan Associates, 2017).

As the case of Sonic Interfreight Co., Ltd who provides the service of LCL ocean freight, there are two warehouses in the operation. One is the free zone warehouse that provides the service of keeping imported product and delivers for customers, and another one is the warehouse for LCL operation (Freight Filte, 2013).

### **1.1 Problem of Company's LCL Warehouse Found in First Observation**

According to researchers conducted first observation visiting the company in January, In the case of Sonic Interfreight Co., Ltd, the problem is in the process of unloading/loading, space utility, and putting away process. Researchers will describe the problem in more detail in Chapter 4. According to warehouse & distribution management uploaded by Professor Nattapon Kessakorn, normally there are five processes in the simple warehouse, and they are receiving, put away, and storage, as well as picking, and shipping process. On the other hand, for cross-docking warehouse there are less process, receiving, shorting and shipping.

Before going deeper in the problem, more detail of activity in each operation will be explained. Firstly, receiving operation, this is the first operation of the warehouse. It consists of two main activities, unloading and inspection. Similarly, the shipping operation also consist of loading activity. Inefficient loading and unloading performance cause time consuming and product damage, and the cause of inefficiency is the warehouse floor level. When the level of the warehouse floor is equal to the ground floor, there have to be loading ramp to support.

In the Sonic Interfreight Co., Ltd case, the warehouse for LCL service use bulk/block stacking storage type. Block stacking is storage product on the pallet and put the pallet on warehouse floor. Stacked 2-3 layers depending on the strength of the packaging.

The problem was nature of the LCL is different type of goods, so the product cannot be put on the others. That causes the wasting of space in warehouse. Another problem is putting away causes the congestion and inflow order for loading process.

Suggestion stuffing the cargo into the container is placing the goods with goods that heavier under the lighter one. Staffing personal should avoid putting heavy item on the top because it would damage the goods under it. Another intimation for container stuffing is to place the goods in the middle of the container or in other word we have to keep the center gravity of the container in the middle after stuffing to avoid imbalance of the container that may cause the imbalance problem when the container is load into the vessel. As the result, staffer cannot just put the goods in any other. So sometimes they have to move some pallet out the warehouse first to be able to get into to get the pallet that they desire because the door of warehouse is too, then it makes accessible area small(Zulkifli, 2017).

### **1.2 Company Background**

Sonic Interfreight is logistics forwarder and provide comprehensive logistics services. Shipping services worldwide with efficient transport management system.

The company has developed into a one-stop logistics service provider. Logistics is not only a transportation management. Company provides transportation design shipping services to appropriate with needs of the customer. The company has been trusted from many customers as a designer and a specialized consultant, so company can answer the logistics management problems

for domestic and foreign customers. Sonic Interfreight Co., Ltd provide free zone service for SMEs, especially. The free zone is known as the "King Kaew LCL Free zone" that would act as a dock. Sonic Interfreight is a provider of logistics full service including service vehicles. It is available in a One Stop Service, which does not need to unload product all at once. The product can be taken out of free zones in the desired quantity. Inventory stock can storage in this free zone and pick up product when customer need. The tariffs will occur when the goods leave the free zone only. All of service are managed by the company. It provides service including transport services, company have a complete range of ground transportation service. Currently, we have 63 semi-trailer trucks and 144 trailers to support the expansion of our customers' freight and reasonable price. Sea services, company offer an array of services, which include arranging for reservations and providing details regarding the dates of departure and arrival, names of the mother vessel and feeder, shipping routes, and name of the port. Air services -they have a complete range of ground transportation service (Sonic Interfreight, 2017).

### **1.3 Objective**

1. To identify warehouse's operation used for LCL freight. For study less than container load service of company and how employee work. Work process of less than container load. To find method used for solve problem for increase efficiency in warehouse operation. Reduce risk of product damage when loading product into container.

2. To investigate how to change layout to improve time efficiency and space utilization of warehouse. Because LCL layout of warehouse is inefficient. Level of warehouse floor of LCL load cargo area is lower than level of truck it can be difficult to work and risk to product may be damage.

3. To calculate and measure efficiency of performance when improve and change layout of warehouse. Explain why the company should improve. Show result and describe what the benefits are when they improve.

4. To obtain new concept about layout of warehouse efficient and suitable with the company.

Researchers review many papers that related to the study. It starts by talking about design warehouse layout of LCL to Improve Time Efficiency and space Utilization. Those papers and article were public on reliable source and website.

The following are the theories or information that we get from those researches. Then it introduces:

## **2. Research Methodology**

### **2.1 Data Collection**

Researchers collectted data for used in research. Researchers collect data by interview employee in office work related document in warehouse and employee work in warehouse. Secondary data all of last year because period of time to do thesis is not enough to collect data the whole year. Study process of unloading product into warehouse until loading product to container for export. The data researchers collect are follows:

Previous one years about warehouse information from employee work related document. To used information for study problem in warehouse. Study real work process in warehouse. Employee of company describe and bring researchers to study the system and real work process in warehouse.

How did they work? how to loading product up to container and give example of document. Document detail is invoice, type of product, quantity and etc.

Researchers interview supervisor and employees in work in warehouse. Researchers think and consider questions before interview them. Whether it would be appropriate and to gain the most useful information. Example of questions is types of product, period to storage in warehouse and work process of employees in LCL warehouse.

## **2.2 Define Problems**

Researchers define problem occurred in company case study. Study information gain from company and study real work process. Researchers identification of problem by two way as the following:

1. Identify by work place observation
2. Asking respondent of define the problem that they have met.

## **2.3 Analysis and Interpretation of Data**

When researchers gain the information is available. Information collected it will be analyze in various forms and find conclusion of data. Analysis of the data obtained from the study. The researchers describe statistics by using Microsoft Excel to calculate S.D. (Standard Deviation) and mean of data. Find defect and find correct solutions. Evaluate data and information to study and how to solve problem.

## **2.4 Design New Layout and Process**

Improved key performance indicator to better measure performance. Measure result when use new process or new concept to improve, design warehouse layout for increased efficiency. Reduce costs to drive forklift to pick up product for loading to container. Use KPI to improve warehouse performance. To know if adapt new process is working it is more work efficiency.

## **2.5 Compare between New Layout and Process to the Old Way**

After researcher study the problem and finding a solution to the problem. Measure performance and evaluate performance. Bring the results to show and compare the results obtained. New solution and new process is more effective and how different from the old system.

## **2.6 Participants**

The interview is conduct with two supervisors and four operational staffs in warehouse.

## **2.7 Research Instrument**

The face to face interview was employed as the instrument of this research. The following are the sample question that researchers asked in the interview.

**Table 1** Interview Question

<b>Supervisor</b>	<b>Operation staffs in warehouse</b>
<ol style="list-style-type: none"><li>1. How big current capacity of warehouse layout? (Pallets per day)</li><li>2. What is your opinion about the layout of the warehouse? Do you think it has any problem or not? In your mind what should be improved?</li><li>3. How many permanent operation staffs in the warehouse? Is the labor being enough? If not, how many outsource staffs will be hired?</li><li>4. How is the warehouse capacity to keep cargo. Is it big enough?</li></ol>	<ol style="list-style-type: none"><li>1. What is your opinion about the layout of the warehouse? Do you think it has any problem or not? In your mind what should be improved?</li><li>2. How much material handling in the warehouse? (Forklift, loading ramp, pallet) it is enough? If not what kind of problem that cause by this?</li><li>3. How is the warehouse capacity to keep cargo. Is it big enough?</li><li>4. Is there any problem with using loading ramp?</li></ol>

## **2.8 Data Collection**

To answer research question, the researchers conduct a focus group interview with supervisor and staff in warehouse. To gather the information researchers used two types of information. They are primary data and secondary data. In order to get secondary data researchers request for the cooperation from company. The data that are provided by the company monthly are old cargo flow record, operation background information and operation time schedule. Moreover, researchers also use secondary data such as textbooks, research article, public thesis and other information that can be found on the reliable website to that relate to the topic and help the study.

Another crucial data is the primary data. In order to collect primary data researchers conduct a face-to-face interview with four different people who are the most familiar with LCL operation of Sonic Interfrieght Co, Ltd. Researchers arrange the appointment to meet and make face-to-face interview. It is the most effective way to get high attention from respondents, and it can ensure that the information is clear because interview can use body language to explain and can see interviewer reaction which can be inform them whether interviewer understand or not.

## **3. Results Analysis**

### **3.1 Problem with Using Loading Ramp**

According to the answer from interview, one of the problem of LCL warehouse is the absence of loading platform. Now loading process depends on loading ramp which is not convenient, high risk, and time consuming, as well as limitation due to weather especially in rainy season.

Level of warehouse floor is lower than level of truck: The problem is the level of warehouse floor is lower than level of truck. So, loading goods into the container is difficult, and risk of during loading process is high. Product can fall and damage.

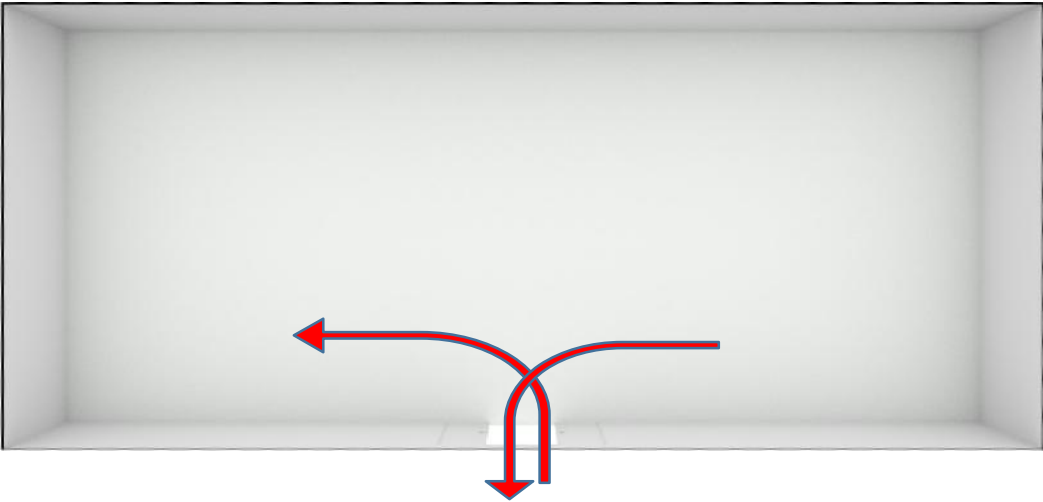
As what a loading supervisor said, most of the case of cargo falling down occurred when the forklift was driving on the loading ramp. On the other hand, if we compare the speed of the forklift drive on floor and the speed of forklift driving on loading ramp, it shows obviously that forklift drive loading ramp nearly two time slower than drive on the floor. Furthermore, the other problem that associated with using loading ramp is raining. In fact, loading ramp required the loading process outside the warehouse which cause longer distance and the problem in rainy season. The time that they spent driving forklift from the door of warehouse to the door of container on a loading process is approximately 32.68 seconds.

**3.2 Crossing Path Problem**

According to the seven principles of warehouse, one of the principle is one-way flow which recommend designer to make sure that the flow is in one direction regardless the path structure like straight, clock wise, counter clock wise as well as up or down(Walker, 2018).

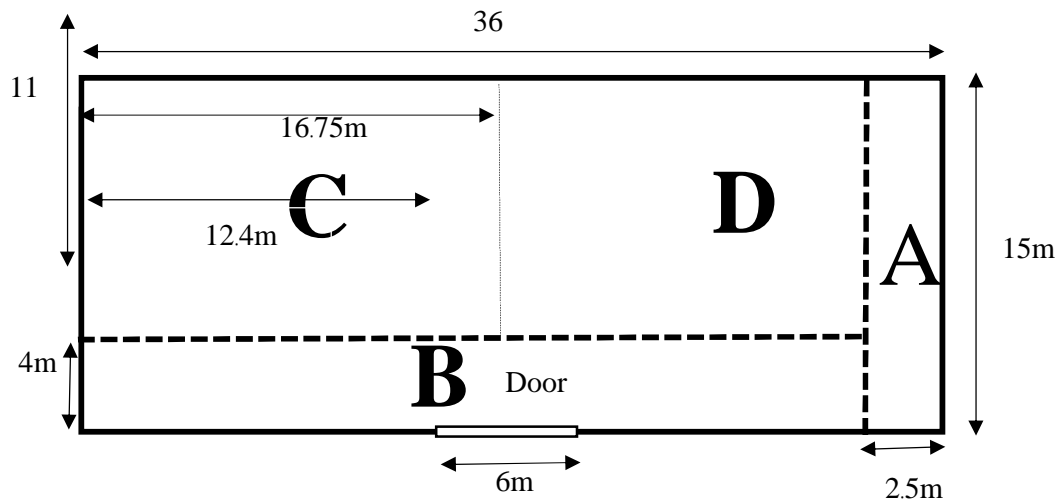
Furthermore, according to warehouse print principle, in the inbound and outbound area section, it is stated that inbound and outbound dock door have to be separated in order to get sufficient the dock door. The purpose of the segment is to avoid the cross between inbound and outbound(WarehouseBlueprint, 2018).

Thus, the loading and put away path should not cross each other. As the Figure4.7 warehouse has only one door, so when loading and put away are operated in the same time it will make the process slow. According to the information in Figure4.10 almost a lot of cargo come in the same day of loading day, so the case that loading and unloading in the same time occur very often.



**Figure 1** Warehouse with One Door

Warehouse layout inefficiency, according to the observation usable area for storage are only in zone C, D, and some part of Zone B.



**Figure 2** Warehouse Layout

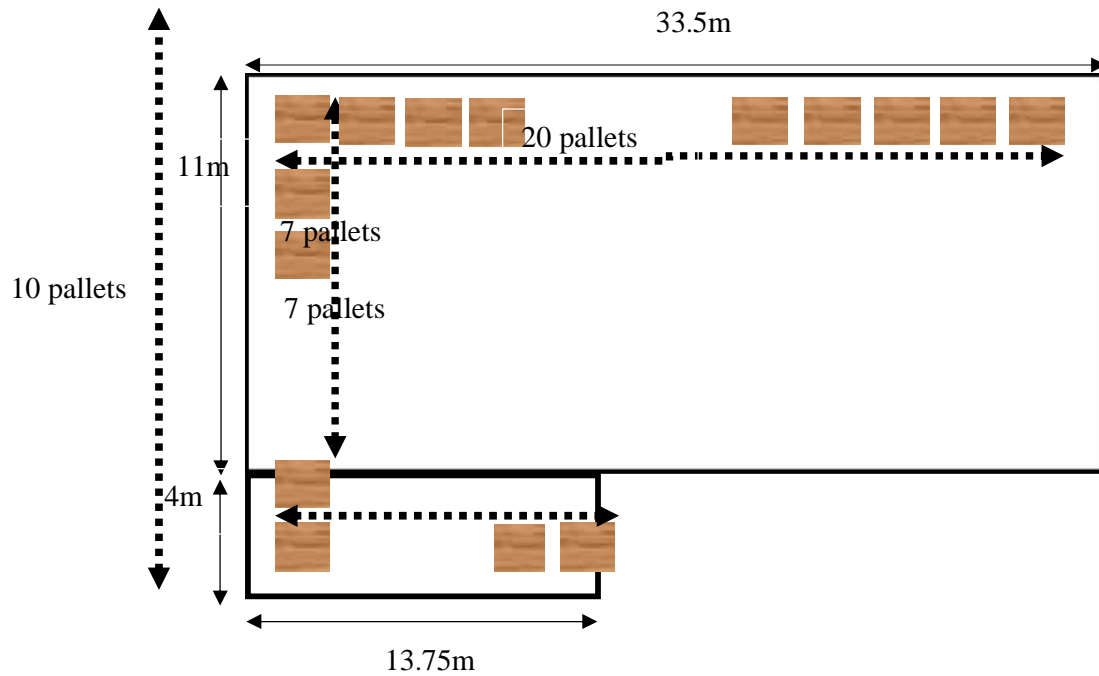
By see the Appendix F which is the calculation to find the area to calculate the number of pallets cans storage in warehouse.

Formula for area of rectangle = Length\*Width

So, the total usable area is only  $423.5m^2$

Furthermore, the average space between each pallet and between pallet to the wall is 40cm or 0.4m. As researchers assume in the resume part the pallet dimension is 1000mmX1200mm. or 1\*1.2m.

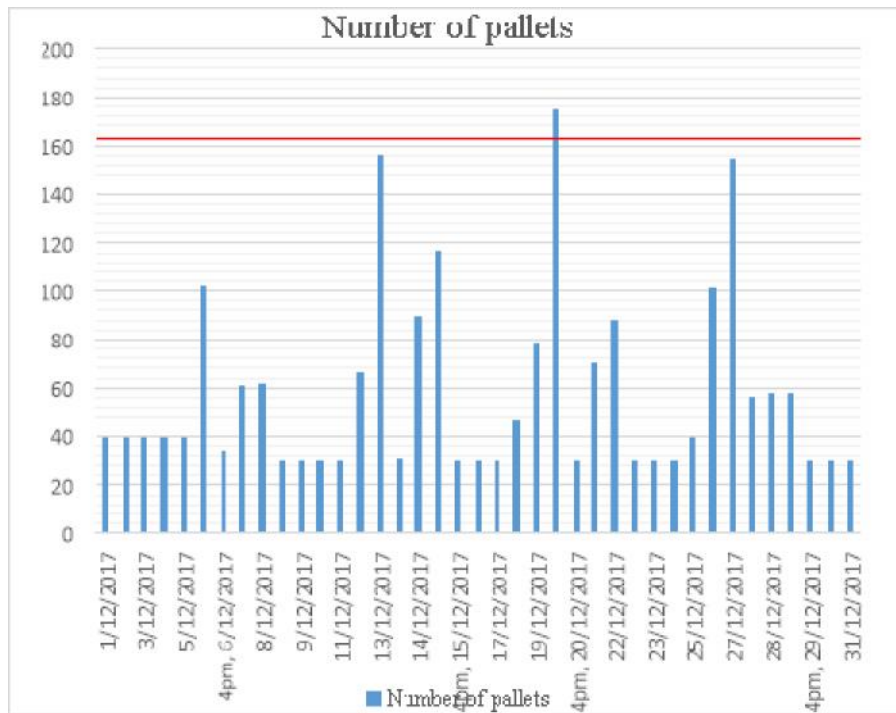
By following the calculation in Appendix F, the total number of pallet that the warehouse can store is the sum of number of pallet in zone C, D, and some part of B that equal to 161 pallets. The following figure illustrate how the pallet can be put in some area of the warehouse.



**Figure 3** Pallet in Warehouse

According to the answer from interview, there are approximately 30 pallets that are not LCL cargo. Appendix G shows the date and the amount of cargo in the warehouse each day in December. The following chart is showing the number of pallet in December, 2017.



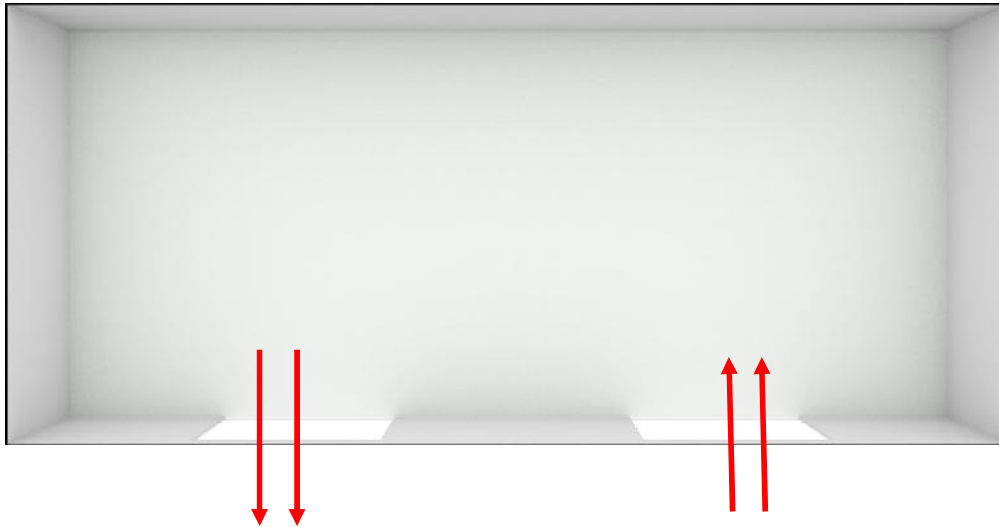


**Figure 4** Chart of The Number of Pallet

As we can see in the graph and Appendix G, 20, December 2017 the number of pallets, 175 pallets, exceeded the capacity of the warehouse, 161pallets. It also, moreover, agrees with what researchers get from interview that the case of lack storage space normally happen one or two time a month.

**Suggesting solution**

- 1. Solution for research question 1: how to improve time efficiency
  - 1.1 Design new layout



**Figure 5** New Design Layout

To facilitate the flow of cargo in and out, new warehouse layout with two doors can be implemented. Increase the speed of work and convenient. Because there are 2 doors in and out. Staff do not to wait for the forklift to come in or out anymore.

According to the data in the table above in December almost a lot of cargo come in the same day of loading day, so the case that loading and unloading in the same time occur very often. The limitation of this layout is losing some space in Zone B.

### 1.2 Build Loading Dock

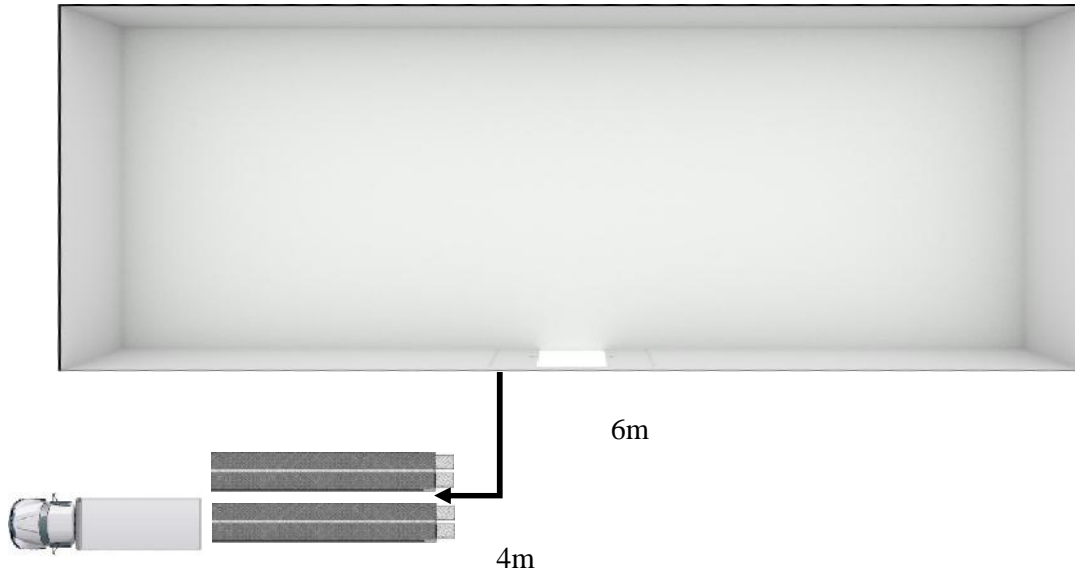
By using loading dock, we don't need to use loading ramp any more. so, the risk of cargo falling down is omitted. It allows the staffs to load cargo even it is raining. As the data show above the time we drive on loading ramp is approximately  $8.63+7.65= 16.28$  second per loading.



Source: Warehouse Loading Dock Lift Systems (2018)

**Figure 6** Build Loading Dock

And it can reduce the distance that forklift have to drive around 20m per loading. Thus, in total the operation time can be reducing 32.68 second per loading or approximately 6 hours per month.



**Figure 7** Distance and Loading Ramp

Advantages are shortening the distance to drive forklift to picking goods out of the warehouse to loading the container. Help saving time and reduce time of work and help to work faster. This will preserve the product, reduce product drop or damage incurred during loading. This may be cause from poor packing of customer or anything. Increase the work more effective.

## 2. Solution for Research Question 2: How to Improve Space Utilization

### 2.2 Installing Pallet Rack

To improve warehouse storage capacity, the company, have a plan to invest on installing pallet rack in the warehouse. Researchers suggest to different options for warehouse owner.

Option1: Install the pallet rack with Narrow Aisle and purchase Narrow-Aisle Forklifts

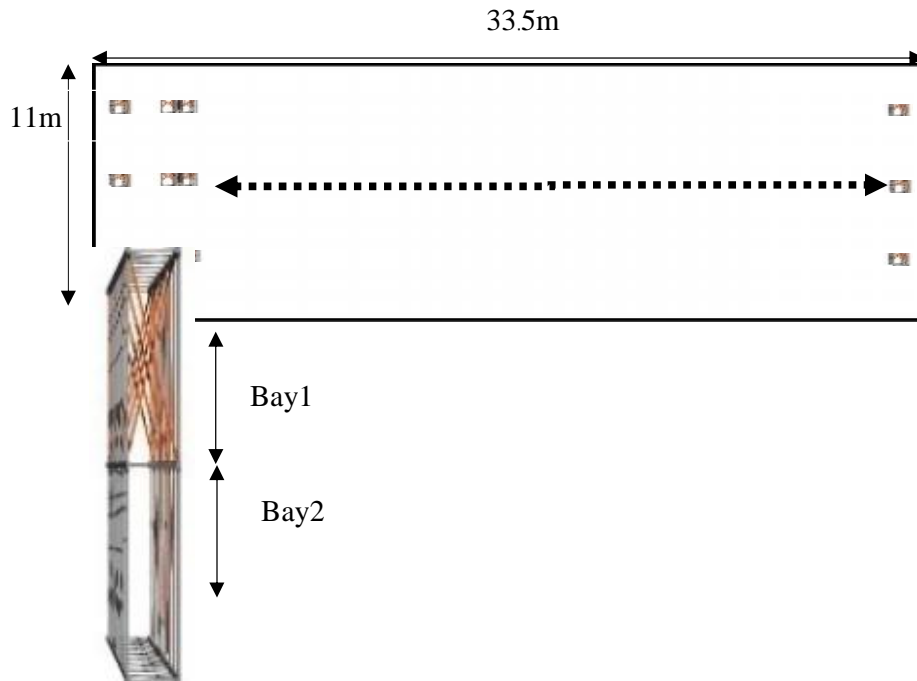
The following is the specification of pallet rack

760cmHeight Pallet Racks

Dimensions \* D \* H: 300cm X 120cm X 760cm

No. Of Levels: 5

Capacity: 12 Pallets



**Figure 8** Install the Pallet Rack with Narrow Aisle

With narrow-aisle forklift we can downside the aisle up to 200cm. So, the total rack in warehouse is 52 bays which equal to 624 pallets which mean the capacity of warehouse can increase 463 pallets (from 161 to 624).

Advantages are increase capacity to storage product more but company has to invest in new special forklift that are suitable for use in new pallet rack. Because there is narrow aisle can't use the old forklift. But I think investing in new forklift is just the first time. It can be use in the long time and more utilization of space. Increase revenue for the company.

Option 2: Install the pallet rack with wide Aisle and use old Forklifts

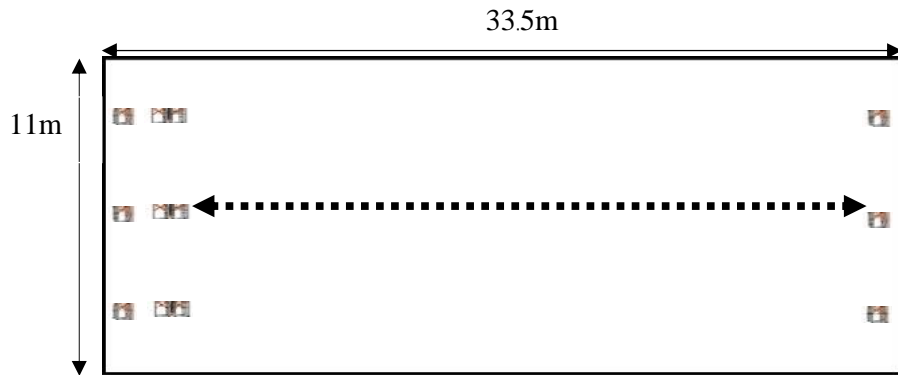
The following is the specification of pallet rack

300cmHeight Pallet Racks

Dimensions W \* D \* H: 300cm X 120cm X 300cm

Number of Levels: 2

Capacity: 6 pallets



**Figure 9** Install the Pallet Rack with Wide Aisle

With wide aisle the space between each bay is can wide up to 300cm. So, the total rack in warehouse is 44 bays which equal to 264 pallets, which means the capacity of warehouse can increase 103 pallets (from 161 to 264). Advantages is pallet rack it is wide aisle and the ability to use old forklift. No need to buy new forklift and lower investment.

#### **4. Conclusion and Recommendation**

##### **4.1 Conclusion**

This research is about design warehouse layout of LCL to improve time efficiency and space utilization. The objective of research is to study the warehouse layout to storage product, to optimize the layout of company's warehouse case study, and to increase the storage area more. In the day when there are many products to storage in the warehouse. Area of warehouse is not enough storage space. Product it can be place on the floor only, or sometimes if the storage area is not enough. Company will build a tent outside the warehouse to store product that can be splash from the rain but the product that cannot rain splash will store in warehouse. It can be affect in damage to the product, and from the study about the warehouse of the company case study found problems the following:

Firstly, problem with research question 1, how to improve time efficiency, is the use of loading ramp to load product to container. Employees must be careful when loading product to containers, as they may cause the product to fall and damage. Loading ramp, it uses operation time more than the loading dock. Another difficult is the warehouse has only one door. When loading and put away are operated in the same time it will make cross path which lead to time inefficiency.

Lastly, problem with research question2, how to improve space utilization, is the storage space is not enough for the demand which confirm with Eiampiyakul (2008) who stated that

problems found in the warehouse operations were lack of space. Manage storage area of the warehouse is not worth it. Because they can only placed on the floor.

After analysis collected data to point out the significant problem. Researchers also suggest the following solutions:

Firstly, to answer the research question1, how to improve time efficiency, researchers suggest to build loading dock help to reduce operation time and distance to loading product to container because when use loading ramp employees must use forklift to pick up the product and load the product to container outside the warehouse.

If using loading dock, it will reduce the time and distance to pick up because the container can park in dock. It also increases the efficiency of work. Thus, in total the operation time can be reducing 32.68second per loading or approximately 6hours per month. Do not careful product fall and damage during loading. Another suggestion is, designing new warehouse layout with two doors for facility to in and out when loading product and increase speed of operation.

Lastly, solution for research question2, how to improve space utilization, install pallet rack for increase capacity researchers suggest two options between install the pallet rack with narrow aisle and purchase narrow-aisle forklifts and install the pallet rack with wide aisle and use old forklifts. This is related to Bergen, (2011) who stated that there are concepts of designing warehouse. Firstly, fixed layout which mean the number of aisles and the length of aisles remain the same for a long period of time.

## **4.2 Suggestion**

For the recommendation, to who want to use the result of this study especially the company in this case, the company can decide the problem that their warehouse is facing which some of the problem are difficult see without research study and data analysis. Furthermore, it is not only benefit to company that is in the case in the case study but also other related business can also consider as the typical problem that most of LCL warehouses have. For suggestion of the future study, it should research on the effect of changing from bulk to pallet rack on forklift path and driving time as well as the cost of implementation.

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