International Journal of Management Science
2014; 1(2): 43-46
Published online August 10, 2014 (http://www.aascit.org/journal/ijms)

AASCIT American Association for Science and Technology

Keywords
Optimization,
Pallet Loading,
CAPE PACK

Received: July 02, 2014
Revised: August 07, 2014
Accepted: August 08, 2014

Optimization of pallet management for transportation efficiently

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Citation
Adsavakulchai S.. Optimization of Pallet management for Transportation Efficiently. *International Journal of Management Science.* Vol. 1, No. 2, 2014, pp. 43-46.

Abstract
A pallet is used in transportation and logistics in order to handle the products from the manufactures to the retailers. However, in pallet industry, the pallets may represent a sizable investment by a company in operating assets which have enough real, intrinsic, regulatory or strategic value to warrant tracking. Thus, the paper aims to optimize the pallet loading in pallet production industry for transportation efficiently. Using CAPE PACK program is implemented the pallet loading, the product packaging design evaluating, and the product distribution. The results demonstrated that the new loading pallets design using CAPEPACK can reduce the transportation cost by 21.0% per year. Moreover, to manage the pallet in each track, the program did a track space optimization to contain the pallet with increase load capacity by 26.67%. Backhaul technique is the process of a transportation vehicle returning from the original destination point to the point of origin that increases income 29.8% per year. On-going research, to propose the renewable energy such as natural gas for vehicles (NGV) is one of the methodologies to reduce the transportation cost.

1. Introduction

Pallets are widely used throughout industry, primarily for shipping of products. Many companies dispose of used pallets without regard to their condition. Pallets used to be disposable items that were good for a few transports and when they broke they would be thrown out. Two major changes in the industry have changed the way pallets are managed. The first change was a continual rise in the price of lumber. In 1998 wood pallets represented 90% of all the pallets manufactured. With the rise in the price of wood pallets became more expensive to replace when they broke. The other factor which affected Pallet management was the rising costs of rubbish removal. Pallets were now both expensive to buy and expensive to throw away when they brake.

The convergence of advancements in technology, market demands and the globalization of logistics has lead to the emergence of a new supply chain execution applications area; Pallet management systems. All the potential Pallet patterns determine and select whichever one provides the greatest stability to ensure less risk of the Pallet load falling over when being moved. As Pallet management systems suppliers expand and integrate with other supply chain solutions to fill out their functional capabilities should see true global asset identification, management and optimization capabilities. Combined with

existing industry initiatives such as pooling Pallet management systems will become a more globally accepted and critical technology.

CAPE PACK is a complicated group of programs which combines a user friendly style with graphics technology, making it as a tool for Pallet loading, evaluating product packaging design, and product distribution. CAPE PACK can create several of solutions for loading cases onto pallets by entering data that relates to the case size, the Pallet size and any loading restrictions which might apply. The program also handles package arrangement and case design, primary package optimization, mixed product displays and promotional Pallet loads.

Designers and engineers can simply select the program groups they need to design and redesign their packaging, test outer case materials and sizes and create mixed product pallets for retail display purposes.

Thus, the main objective of this paper is to do the optimization of pallet loading in pallet production industry.

2. Methodology

To analyze the parameters that lead to the organization transportation cost using cause and effect diagram.

To do the priority of each parameters using Pareto Chart.

To do optimize the pallet management as following:

1. To analyze the optimization of Pallet loading using CAPE PACK as a tool for pallet loading
2. To analyze product distribution using backhaul technique
3. To analyze the product packaging design
4. To synthesis data for recommendation

3. Data analysis

3.1. Cause and Effect Diagram

After data collection was completed, there are four main parameters that lead to the high transportation cost are management, method, material and man as shown in Figure 1.

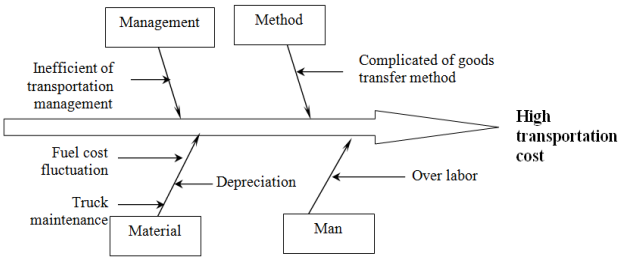

Figure 1. *Cause and Effect Diagram.*

Management: Due to this company is the one of the small and medium enterprises (SMEs) that is inefficient of transportation management. This is because the limitation of vehicles are only six heavy trucks and one light truck. Moreover, the transportation distances among customers are very far comparing with the competitor.

Method: According to the pallet is made from wood that is more weight and require the space during transportation. Material handling from place to place using the pallet leads to the complicated of goods transfer method i.e. goods handling using Folk Lift and Hand Lift.

Material: The main factors that affect the transportation cost are depreciation cost and maintenance cost that cannot avoidable. Moreover, fuel price is fluctuation that impact on the factory that located far from the customers.

Man: Labor is the other factor in transportation that carries out all goods from place to place.

3.2. Pareto Chart

From Cause and Effect Diagram in Figure 1, the factors that are the impact on transportation cost are fuel cost, labor cost, depreciation cost and maintenance cost as shown in Figure 2 and Table 1.

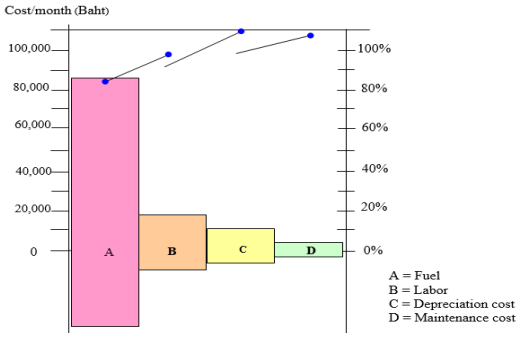

Figure 2. *Pareto Chart.*

Table 1. *Cost analysis in November, 2012.*

Cost	Cost/month (baht)	% Cost brake down	% accumulation
Fuel	86,400	72	72
Labor	18,900	16	88
Depreciation cost	11,667	9	98
Maintenance cost	3,000	2	100

From Pareto Chart, the results are demonstrated as following:

1. The major effects of higher transportation costs are inefficiently transportation management, complicated of goods transfer method, labor intensive and fuel cost fluctuation and truck maintenance cost.
2. From Pareto chart, the transportation costs depends on fuel cost 72%.

3.3. To do Optimize the Pallet Management

3.3.1. To Manage how to Load the Goods in the Full Capacity

To rearrange the loading goods for least space capacity that might be full capacity of track at once time. To do the simulation using CAPE PACK for arrange the goods as

shown in Figure 3 and 4. After comparison between the old and new one, it found that the track can contain goods more from 300 items to 380 items (377 items from CAPE PACK simulation + 3 items using manual added in available space that computer cannot do) including the number of transportation is decreased 21.0% (11,700 baht) as shown in Table 2.

Table 2. *Comparison between the current and propose pallet management.*

Pallet management	# item/trip	#trip/month	Transportation cost/trip (baht)	Transportation cost/item	% decreased	Transportation cost decreased (baht)
current	300	16	3,900	13.00	-	-
purpose	380	13	3,900	10.26	21.0%	11,700

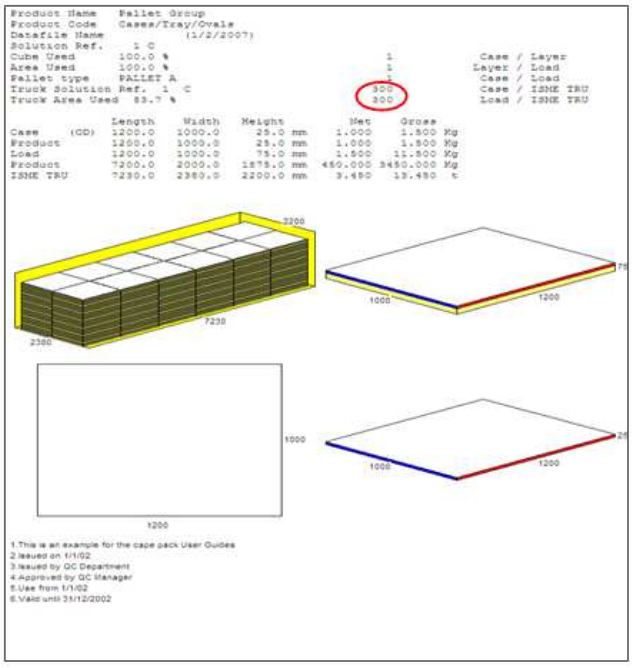

Figure 3. *Pallet Management using CAPE PACK (current).*

3.3.2. To do Product Distribution Using Backhaul Analysis as the Transportation Management

Backhauling technique is an effective strategy to substantially reduce the operating costs. Prior to implementing a backhaul program, several factors need to be considered such as the following: revenue, surcharges, loading times, equipment and driver utilization, claims and customer returns. Each backhaul opportunity needs to be fully analyzed and the impact on the company evaluated to ensure that the revenues realized outweigh the cost or risk to service. All the factors are considered; assuring that the backhaul program has a positive effect on the company and does not negatively impact customer service. To implement the backhaul technique can increase income 29.8% per year.

3.3.3. To Design the New Plastic Pallet for Packaging, Sizes and Create Mixed Product Pallets

From wooden pallet, there are many problems in use i.e. fungi caused from humidity, nail scratch the goods, etc. Moreover, wooden pallet use only time and discard. The plastic pallet is good with reusable, durable stringer pallets. However, the problem is how to reuse without contamination. Thus, to implement the plastic pallet is started from design sizes and manage to reuse the pallets.

Plastic pallet drawing and specification (can reuse at least 12 times) is shown in Figure 4.

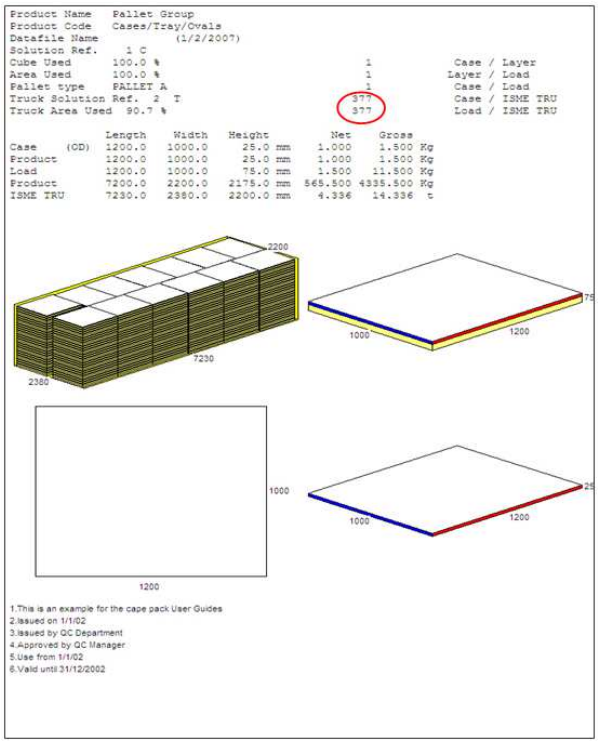

Figure 4. *Pallet Management using CAPE PACK (propose).*

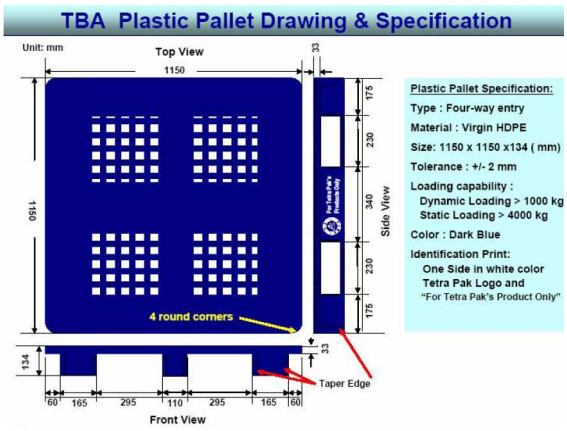

Figure 5. *Plastic pallet drawing.*

From Figure 5, the new plastic pallet design size is 1,150 x 1,150 x 134 mm. under based 3 stores that 175 mm. in both side and 340 mm. in the middle. The space for forklift is 230 mm.

Management estimates that about 7,000 pallets are purchased every year and that about 98% of these are used to transport finished goods to regular clients. About 50% of the pallets are used to ship goods. This presents a good opportunity to do the returnable pallet program. There are many ways to structure such a program. One way would be for the company to purchase the plastic pallets then charge customers an additional 50 baht per pallet for every plastic pallet shipped. If customers returned the pallets, then they would be credited for the pallet charge. This would force customers to pay the shipping fees for returning the pallets and would encourage them to minimize this cost by waiting until they accumulate a full truckload of pallets. You could also slightly reduce your selling price to account for your reduced pallet costs. Thus, the net cost to the client would be the same or less than before and they would be happy to participate. In this way, both you and your customers would share the savings of using returnable pallets.

4. Conclusion and Discussion

It can be concluded that the optimization of pallet management for transportation efficiently are as following:

1. To manage the pallet in each track using CAPE PACK as a tool, the program did a track space optimization to contain the pallet with increase load capacity by 26.67% and reduce transportation cost 21.0% per year.
2. To do product distribution using backhaul analysis as the transportation management can increase income 29.8% per year.
3. To design the new plastic pallet for packaging, sizes and create mixed product pallets that is good as a green logistics

The importance of efficient transport for business, this bring benefits to the fast moving consumer goods business but it will ultimately benefit the society as a whole: less pollution, less congestion and timely availability of products to the consumer.

Acknowledgement

I would like to sincerely thank Mr. Surapong Aiengchareonsuk for data correction and to do the simulation.

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