

# PREPLANNED TRUCK OPTIMIZATION USING CARGOWIZ

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## ABSTRACT

Most of the production industries in the world are still not using the advanced truck loading software to optimize the truck. Optimum loading of goods in a truck has been a huge drawback for many firms. Truck Optimization can be done either by manually or by the use of software. CargoWiz truck loading software is used to optimize the truck. The boxes that can be loaded in excess by using CargoWiz have to be analysed and the benefits of using software for loading the truck was explained in a brief. In future the software with better algorithm will be developed to optimize the truck effectively. A dairy firm case has been taken in this study and load plan was created using CargoWiz. Then the CargoWiz solution is checked with the real time loading condition to find whether more boxes can be loaded or not.

**Keywords:** Optimization, CargoWiz, Truck Loading

## 1. INTRODUCTION

Truck loading plan is very important thing a company has to consider in order to save the cost by minimizing the number of trucks for transporting the goods. The load plan for a company varies based upon the goods that it produces and the packing materials.

Yanfang et al. (2015) researched about the cold chain logistics involved in perishable agricultural products in China. Initially the issues involved in every cold chain logistics process is analysed and the suggestions are given to solve the issues involved in the cold chain logistics. Finally, these suggestions are needed to raise the income and the consumer safety. But usually customer safety priority usually increases the price but on the other hand reduction in production cost. Let us now see the various ways in which costs can be reduced. As suggested by Gaggero and Tonelli (2015) who plotted the demand, inventory levels and wasted goods by means of discrete-time dynamic model. The simulation for three scenarios was tested by discrete-time dynamic model where they lack.

Apart from this we can also reduce the cost through the minimal and desired changes in the containers used in the manufacturing process. Bandara et al. (2015) explained the difference between the standard and the foldable container. He conducted qualitative research methodology to gather information in the form of questionnaires. And finally suggested that foldable containers will reduce the cost involved at the seaports and the space allocation of containers will be also increased. This will help the logistics industry also will reduce the cost and increases the customer demand. After these containers are made, there is a usual confusion on how to store and handle them. Zhang et al. (2014) suggested three new dynamic programming models for handling the container. These models will be helpful in solving the stacking problems of the container. This approach will save time and the cost involved in storing the container in the terminal. Finally, suggested two-stage heuristic approach for solving the issue.

Dayama et al. (2014) explained the problems that are caused in stacking the containers in maritime ports. Then optimizing the crane sequence will minimize the cost in restacking the containers and the time involved in restacking it. Various MIP formulations are used to analyse and then based upon the solution he suggested the best way to solve the issue is by through the development of efficient heuristic approaches.

Coming to the logistics part, Farias and Akabane (2011) gave new inventive patterns for solving the issues in the logistics. TRIZ methodology is one of the best ways to solve the logistics issue but there are other inventive and creative methods for solving the problem. The method involves costs, processes, quality and customer satisfaction.

After the efficient handling of containers and thereby reducing the costs customer hands on of the product is important. For that purpose, there is a need for way for the finished goods to reach the customers. According to Cheng et al. (2014) there can be a presence of a cloud-based auction tower strategy through which the products can be sold online. The buyer has to bid for the product and the highest bid will be selected and then buyer and seller will discuss with buyers about the auction and the transaction details. This method has improved the market efficiency and effectiveness as well as supply and demand information visibility.

Prakash et al. (2015) researched about the energy utilization that with rise of data in recent decade has played a huge role in opening up of a field called as the data analytics. But none would have thought that this data collected would invariably affect the presence of CO<sub>2</sub> in our atmosphere in initial times. Thus, there came a necessity not only to optimize the data collected but also there is a requisite for the processes of optimization of energy for the same. This coincidentally led the path for cloud systems to evolve which not only proved efficient but also helped to be eco-friendly. For example, if in case of any unscheduled activities, it finds the suitable virtual machine and reconfigures the data centre by minimizing the energy utilization. The experiment result indicates that the proposed gradually reduces the energy consumption. As we can notice scheduling plays an important role in the process of optimization in this case of unscheduled activities as they save lot of resources and thus making an efficient through optimization

Above said literatures focuses on optimizing the truck using different methodology – Triz Methodology. This paper highlights the importance of CargoWiz which can be useful for truck loading optimization.

## **2. ISSUES IN TRUCK LOADING**

Optimization of truck is very difficult to do manually. It requires proper planning and a load plan. Manual load plan is difficult to make and it is time consuming. The products should be stacked in a correct manner so that it won't be damaged because of boxes which is placed one over the other. The timing for loading the boxes in the container will vary significantly based upon the box quantity. The truck dimensions will vary and it won't remain the same. The box quantity will also determine the type of truck that is needed for transferring the goods. Manual planning would sometimes even result in excess cost than the actual which is being required.

## **3. CASE ON DIARY FIRM**

The dairy plant consists of three different logistics department classified upon the shelf life of the products – Commercial (long life products – ghee, milk powder, whitener), Despatch (short life products - Curd, milk) and Tanker (procurement of milk). The dairy industry follows FIFO approach to ensure that goods are dispatched in batch wise. This dairy industry also has FGIS (Finished Goods Inventory Stock) procedure to ensure the quality of the food which is stored in the warehouse after production. Goods which is produced will be transferred to the plants own distribution centre around the country. Without FGIS the products can't be stored in the warehouse. Totally, the dairy firm consists of 13 plants throughout the state.

The commercial logistics have three different types of trucks for dispatching the goods – open type truck, closed container and small vehicles. All the vehicles at the dairy plant are on contract basis. Once the vehicles are loaded and dispatched the third-party logistics will take the responsibility. So, loading should be properly planned and dispatched. Per day 10 – 30 trucks will be dispatched from the plant. 5 – 8 labours are required for loading the truck. The wages of the truck will vary based upon the type of the truck used. The commercial logistics transfers the finished goods to the distributors. Since the goods are transferred to the distributors, the truck needs to be optimized.

The area where the commercial logistics is facing problem is the optimization of the truck. The truck is not optimized fully to its potential that it can hold. Free spaces which are present in the truck have to be filled with boxes based upon the volume. One of the major reasons why the truck is not optimized properly is because of improper planning. CargoWiz user-friendly software is one of the ideal solutions for solving the truck optimization issue. All the data's regarding the optimization can be stored in it. Billing can be also done using the software. This software also reduces the time required for planning the optimization.

## **4. METHODOLOGY AND PROCESS**

The present loading conditions has to be analyzed thoroughly which includes the loading procedure, methodology and the time for loading. The free spaces should be noted down and at the end the total weight of the truck should be also note at the weighment bridge. The standard dimensions of the truck and the boxes should be noted in this step. The dimensions are necessary for calculating the free spaces which is needed to be given as an input to the software. The data which is collected by measuring the truck and box dimensions should be loaded in the software. Then CargoWiz provides an optimum solution by adding the boxes so that volume and the weight will be fully utilized in the truck. Once the truck optimization is completed the load plan will be automatically generated from the software. The load plan should be checked and changes had to be made in order to ensure loading is done properly. Once the load plan is generated, using the load plan the boxes should be loaded in the truck. If the excess boxes which added by software can be loaded and the truck is optimized fully both by volume and weight wise, then the software is applicable.

#### 4.1 LOADING WITHOUT PLANNING

Based upon the STO all the boxes are loaded in truck. For loading this STO the time taken is around 170 mins with 5 labours. The loading was done from one side starting from inside to outside and from right to left. The boxes are loaded in 8 columns and 17 rows at a height of 8 ft. Lightweight materials like Aniva jars and Dairy Whiteners are not placed on the bottom. These boxes are placed in the middle and almost at the top of the trucks.

Visually there are lot of free spaces available and one row at the top of the truck is not filled. The Pet Jars 1000 ml and 500 ml are placed at the bottom because they can withstand the weight. These jars have no limits they can be placed anywhere in the truck.

The total weight of the truck after loading is 15880 Kg.

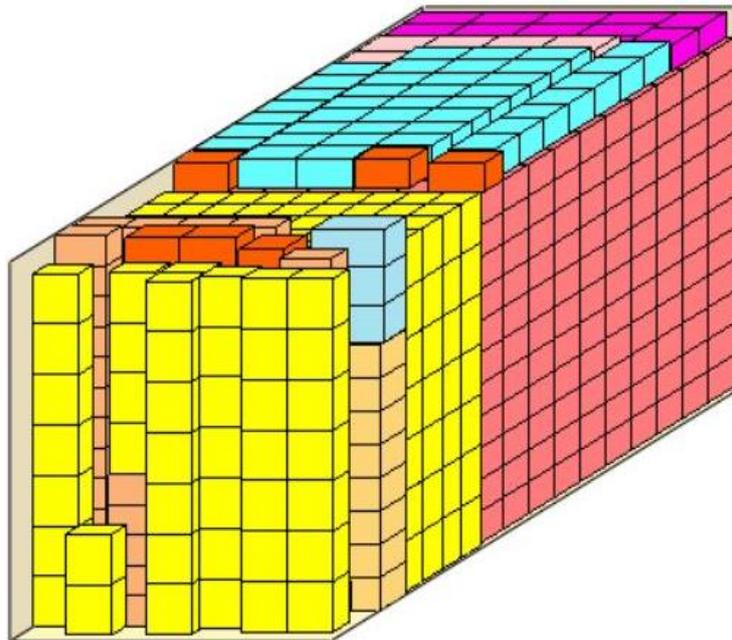


Figure 1: Load Plan before CargoWiz

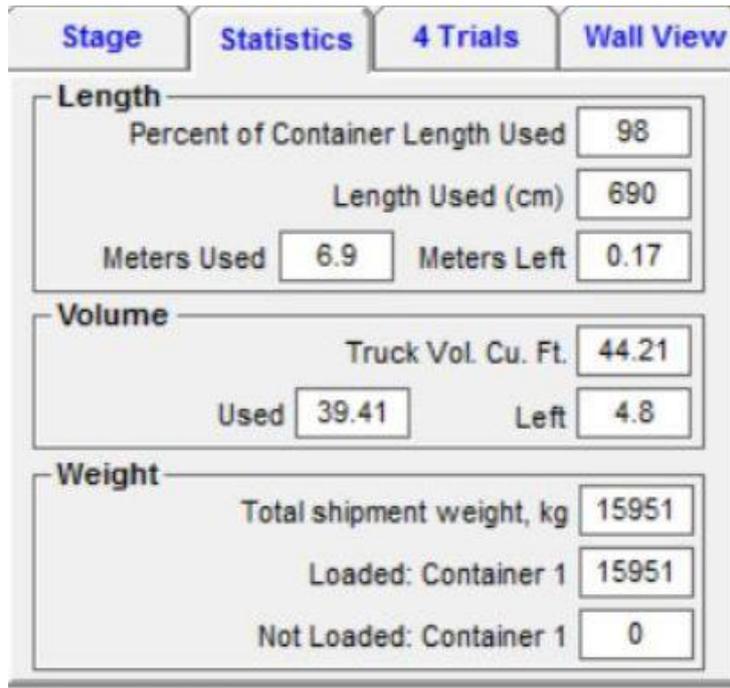


Figure2: Load Plan Analysis before CargoWiz

#### 4.2 TRUCK OPTIMIZATION USING CARGOWIZ:

Software is one of most effective and most efficient way to optimize the truck. Software plans the loading based on the algorithm which is programed on it. Different software shows different solution because algorithm of each differs. With the help of software, the total volume of the truck can be found and the volume which is used by the software can be also found. The empty space can be utilized and the loading can be pre-planned. Possibilities of errors can be minimized. Not only CargoWiz can solve the truck optimisation issue, there are several other software's available such as PackVol and CubeIQ but they are not the best compared to CargoWiz.

#### 4.3 DATA REQUIRED

The data which is required for the truck loading software is Stock Transfer Order (STO), box dimensions and the truck dimensions. STO is the data based on the demand of the distributors. The box dimensions are fixed based upon the SKU's the dimension will vary.

#### 4.4BOXES DIMENSION

Table 1: Type - Pet Jars

S.No	Name	Dimensions (mm)			Weight		Qty
		Length	Breadth	Height	Min	Max	
1	50 ml	470	286	240	6	6.1	120
2	100 ml	475	290	315	13.51	13.21	120
3	200 ml	385	385	225	11.9	11.76	50
4	500 ml	340	260	350	13.12	13.02	200
5	1000 ml	440	330	220	13.1	13.05	12

Table 2: Type - Pillow Pouch

S.No	Name	Dimensions (mm)			Weight		Qty
		Length	Breadth	Height	Min	Max	
1	500 ml	290	255	245	11.53	11.58	24
2	1000 ml	380	275	210	11.66	11.74	12

Table 3: Type - Ceka

S.No	Name	Dimensions (mm)			Weight		Qty
		Length	Breadth	Height	Min	Max	
1	500 ml	365	275	240	17.93	18.1	32
2	1000 ml	295	225	330	17.7	17.79	16

Table 4: Type - Tin

S.No	Name	Dimensions (mm)			Weight		Qty
		Length	Breadth	Height	Min	Max	
1	1000 ml	444	355	160	13.14	13.25	12
2	5000 ml	366	183	142	10.25	10.3	2

Table 5: Type – Aniva Jar

S.No	Name	Dimensions (mm)			Weight		Qty
		Length	Breadth	Height	Min	Max	
1	200 g	550	460	230	13.95	14.1	60
2	1 kg	410	330	200	11.01	11.06	10

Table 6: Type – DWP

S.No	Name	Dimensions (mm)			Weight		Qty
		Length	Breadth	Height	Min	Max	
1	4.5 g	430	340	210	4.85	5	100
2	27 g	440	430	190	10	10.5	300
3	200g	475	350	180	8	8.1	30
4	1 kg	545	380	260	13.58	13.73	12

Table 7: Truck Dimensions

S.No	Vehicle Name	Vehicle Capacity (max)	Vehicle Type	Length	Breadth
1	Ashok Leyland	18 MT (KELVIN)	Reefer Tarus	29	8
2	Ashok Leyland	14 MT (PROTRANS)	Reefer Tarus	27	8
3	Tata	21 MT - OPEN TRUCK	Normal Tarus	24.9	7.5
4	Ashok Leyland	16 MT - OPEN TRUCK	Normal Tarus	23.2	7.8
5	Eicher	6 MT - DMC	Normal Eicher	17.1	7.1
6	Eicher	8 MT - DMC	Eicher 10.5	18.5	7.1
7	Mahindra	3.5 MT - DMC	Load King	9.3	6
8	Ashok Leyland	1.5 MT - DMC	Dost	7.5	5.7
9	Mahindra	2 MT - DMC	Pick Up	8.5	5.7
10	Ashok Leyland	10 MT - OPEN TRUCK	Lorry	18.5	7.5
11	Ashok Leyland	18 MT (KELVIN)	Reefer Tarus	31.3	7.1

Table 8: Stock Transfer Order

S.NO	Products	Qty
1	1000 ml Pet Jar 12L (N)	714
2	500 ml Pet Jar 12 L (N)	300
3	1000 ml Pillow Pouch 12 L (N)	30
4	1000 ml Ceka 16 L (N)	120
5	Aniva Milk Mix Jar 200 g x 60 (12 Kg)	8
6	Aniva Milk Mix Jar 10 Kg	10
7	Hatsun DWP 4.5 g x 100 (.45 kg)	5
8	Hatsun DWP 27 g x 300 (8.1 Kg)	5
9	Hatsun DWP BIB 200 g x 30 (6 Kg)	10
10	Hatsun DWP 1 kg x 12 (12 Kg)	5
<b>Total</b>		<b>1207</b>

The truck which is required for loading is 16 MT. Total weight of the product is 15925 kg. The truck has to be loaded at a height around of 8 ft because of rules and regulations.

The exact volume of usage can be found, the vacant spaces in the container can be identified. Height of the loading can be identified whether the boxes will fit or not. Vacant spaces can be decreased by identifying and increasing the boxes that will fit it. Load plan document will be provided at the end.

All the billing process can be done using the software. Load plan can be edited by changing the box positions. Even if the dimension of the box is changed by the production department, the size can be modified.

Loading procedure of every box is different, more options like “On the Top”, “On the Middle” etc. are needed to ensure that the software can be trusted. After running the software if the positions are not satisfied, the box positions can be changed by editing it manually but it will take little time. But also requires trained professional for using the software. Stacking is huge problem in this software, stacking limits are given but the stacking weight is not given.

## 5. ANALYSIS AND DISCUSSION:

CargoWiz gives the required data like the volume which is utilized and the weight of the container which was utilized. The volume will be in the form of cubic feet and weight will be in the form of kgs. So if there is free space found using CargoWiz, the boxes have to add and should be checked whether the truck is utilized fully or not. Based on the order the analysis has to be made and then the corrections which are made have to be analysed. Then the best solution has to be taken.

### 5.1 LOADING WITH CARGO WIZ

The height which is required for loading is 7.95 ft. All the boxes are fitted in the container. Free spaces are available because 91.2% of volume is loaded in the truck. 11.362 cu ft. is occupied and 1.10 cu ft. of volume is still remaining. The total weight utilized was 15945.2 kg.

Further 4 1000 ml Pet jar can be added. If the quantity of the products is increased more than 4, Volume wise it may fit but weight wise it can't fit because it will exceed the capacity 16 MT. If 4 1000 Pet jar is added the volume will increase to 92% but the weight of the container will increase to 15997 kg.

The maximum weight of the product is given as an input so there will less probability of occurrence of error in the weightage.

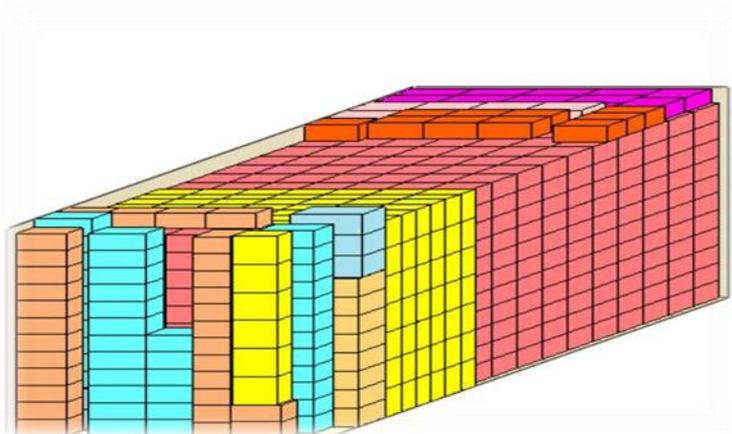


Figure 3: Load Plan after CargoWiz

Stage	Statistics	4 Trials	Wall View
<b>Length</b>			
Percent of Container Length Used		100	
Length Used (cm)		706	
Meters Used	7.05	Meters Left	0.01
<b>Volume</b>			
Truck Vol. Cu. Ft.		44.09	
Used	39.51	Left	4.58
<b>Weight</b>			
Total shipment weight, kg		15990	
Loaded: Container 1		15990	
Not Loaded: Container 1		0	

Figure:4 Load Plan analysis after CargoWiz

<b>Trial Results</b>				
	1	2	3	4
Vol. Used %	88.9	89.1	89.1	88.5
Compact %	89.2	91.4	90.3	89.2
Loaded	1254	1258	1258	1249
Left Out	4	0	0	9
Load Length	705	690	698	702
		↑ Shown		

Figure 5: Iterations

## 5.2 CALCULATIONS

Calculations are made for a single location (X)

Trucks dispatched per month = 60 - 100

Revenue increased per truck = INR 9000 – 2,16,000 / truck

Volume of the box = 0.009511 mm<sup>3</sup> - 0.05819 mm<sup>3</sup>

Cost of the box = INR 1800 - 7200

Boxes can be loaded = 5 – 30 boxes/ truck

Fuel cost saved per truck = INR 17416/ month

Rent saved per truck = INR 1 Lakh/month

Cost that can be saved = INR 3, 79,248 - 10, 00,248/ month

Based upon the observation total number of trucks that can be dispatched per month is 60 - 100. If more boxes are loaded in a truck the revenue will be increased and the spaces in the warehouse will expand. Even if one truck is saved per month, 1 lakh will be saved because of the rent involved in the truck. From the calculations, it is clear that INR 3, 79,248 – 10, 00,248/- month can be saved. The quantity of boxes will also vary based upon the order from the customers. So, the load plan will also change based upon the quantity. Based upon the calculation it is clear that the software can save a minimum of INR 3, 79,248 per month to a maximum of INR 10, 00,248 per month.

## 6. CONCLUSION

We recommend that CargoWiz can be a problem solver for truck optimisation issue. CargoWiz gives almost the exact weight and the volume based on the loading. The loading procedure needs to be followed in order to fully utilise the truck. By analysing the software with the real time loading it is clearly evident that with the use of CargoWiz more number of boxes can be loaded. For a company, which wants to reduce the cost involved in logistics this would be an ideal solution. Investing in the software would definitely save a lot of cost in logistics and it will ideally suit all the firms. Software's will be the future need of any logistics firm for optimizing the truck. Software's vary based upon the algorithm and the program which is being coded. The future study will be based on developing software with better algorithm. These algorithms will determine the success of any logistics firm.

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