



THE RESTRICTIONS COVERED IN THE DISTRIBUTION OF FRACTIONAL LOADS: ACASE STUDY

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ABSTRACT

As the economic crisis in Brazil advances, many transport companies on road charges, are losing ground in the market for lack of planning, quality services, high costs of transshipment and lack of information to its customers. More and more companies have been adjusting to market trends in order to become more competitive and improve their service levels, providing quality and punctual delivery and collections, for that they rely on technology and softwares to improve their performance and reduce costs on shipping. This article aims to analyze the constraints faced in the distribution of fractional loads, in a HUB operation, distribution and collection of a large company, acting as a support arm for this operation, in the metropolitan regions of São Paulo and how to present possible and practical solutions from the techniques and concepts of distribution logistics aligned to technology of routing Road Show software, demonstrating how technical knowledge can add value to the business.



Keywords: Technology, Routing, Distribution.

1. INTRODUCTION

This article is related to the use of technology and the growing demand in the transport sector as well as the need for planning in the operations of deliveries and collections that are impacted directly by restrictions already known as the hours of movement of trucks. During the research some restrictions were observed in the operational processes that affect directly the costs and the levels of services, mainly in e-commerce operations whose main characteristic are the transportation of fractional loads.

In this article, we focus only on the metropolitan regions of São Paulo, where the company is located which served as an instrument for case study. The company did not authorize us to disclose its name in order to maintain its integrity; we made use of a fictitious name and proportional data to those that were collected in the field.

Goldratt (1980) argues that the survival of a company depends, among other factors, on its capacity to participate in a fierce competition established by the market, which demands from its managers, a technical expertise, a large arsenal of information and a proactive stance fundamental to those who want to perpetuate themselves in the market in a continuous process of reinvention perceiving in the internal and external challenges, opportunities for growth.

The choice of the research object was based on the daily experience of the operation, observing recurrent delays and operational failures, which generated complaints and customer dissatisfaction, the problem observed goes to Ballou (2010), in which he states that level of Service applied in logistics is linked to the optimization of resources used and managed to achieve the goals of the company and mainly in the satisfaction of its customers.

Based on the opinions of the aforementioned authors, the research problems guide the capacity of productivity and organization in relation to the activities and layout, space used for HUB operations, through this reflection the following questions were raised: A) Is it possible to optimize the operations performed by the HUB using only the available courses and avoid the loss of delivery times, even in the face of so many restrictions? B) The physical space of HUB and its organization influence the movement of loads?



As a method of procedure for a case study, observing the daily operations to validate or not, the problems and considering that the scientific method is a set of intellectual and technical procedures adopted to achieve knowledge (GIL 1999 apud RODRIGUES 2005).

The relevance of this article is in its rich contribution in the analysis and simulation of real data and use of technical knowledge acquired during the course of Logistics Management, opening up precedents for new researches in this scope.

2. THEORETICAL FRAMEWORK

2.1. Logistics

The main definition of Logistics is from Council of Logistics Management (CLM, 1996), as follows:

Logistics is the process of planning, implementing and controlling the efficient flow of goods and services from the point of the origin to the point of consumption in order to meet customer requirements. Based on this concept, logistics encompasses all existing processes in the flow goods from the origin of the product to its final destination.

For Rodrigues (2005) logistics is the area, which enables harmonize supply, demand, production and distribution of a product, with the objective of reducing costs. The author also mentions the main parameters of logistics, which are: costs and time (quantitative) and quality (qualitative); it can be seen that all the definitions revolve around the concept of always increasing the level of customer service and reducing the logistics costs for the company.

2.2. Transport

According to experts and authors, transport is responsible for absorbing one of the biggest costs of a company, this affirmative dos not meet Ballou's opinion:

Transport is one of the most important activities of a company, "[...] transportation is the most important logistics activity simply because it absorbs on average one to two-thirds of the logistics costs" (BALLOU, 2010, p.24).

According to Caixeta Filho and Martins (2009), efficient transportation must be capable of meeting deadlines with the goal of reducing logistics costs. Products that are delivered before or after the scheduled date may result in higher costs because



of the need for storage and redefining and scheduling the route and new delivery date. These events can have a negative impact on the company's business and cause losses and reduce profits; consequently, loss prevention is the means used to avoid the realization of such losses by carrying out human and / or technological investments.

2.3. Operational Costs

Authors such as Hauser (1986) and Hsu and Goodwin (1995) consider operating costs as an exogenous variable in research that seeks to study the formation of freight values.

According to Batalha (1997), the service offer is organized by carriers in vehicles of regular circulation or contracted especially for certain trips by an own fleet, by service providers and by agents among the various modalities.

According to Martins and Caixeta Filho (2009), when a shipper hires a carrier to collect a batch of volumes and take it to a destination, his expectations are summarized in having his request effectively delivered within the agreed time limit, without damages or losses and within a reasonable a cost and freight.

2.4. Theory of Constraints Applied to Logistics

According to Goldratt (2002), the survival of a company depends, among other factors, on the ability to participate in a fierce competition established by the market and which requires from its managers, a vast arsenal of information and a proactive stance, fundamental to those who want to perpetuate themselves in the market in a continuous process of reinvention, realizing in the challenges, internal and external, an opportunity for growth.

The theory of restrictions can be understood as a set of theoretical principles that ground and synthesize the knowledge of management and control that in turn recognizes the role of limiting factors or restrictions and focuses on them, aiming at increasing overall performance of a system (GOLDRATT, 2002 apud, RODRIGUES; MAYERLE, 2014,).

Restriction can be any element or factor that prevents a system from achieving a better level of performance with respect to its goal.

2.4.1. The Five Steps to Focusing



Goldratt (2002) developed a five-step sequence, figure 1 that functions as an improvement process. Identify the constraint in the system; explore the constraint of the system; subordinate everything to the previous constraint, raise the system constraint and if in the previous step a constraint was broken, do not let the inertia be the next constraint, start the process again.

Such process of continuous optimization is present throughout the method and is capable of leading the company to significantly improve its earnings or reduce costs, figure 1.

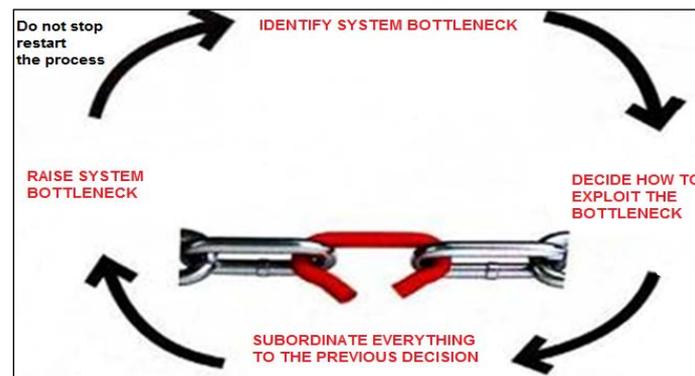


Figure 1: Five Steps to Focusing.

Source: World logistics Magazine (2014), Adapted to English by the authors

In order to apply the Theory of Constraints, Follmann (2009) proposed ToC in transport companies, from a bibliographical research and his experience in the transportation of fractional loads. According to Rodrigues and Mayerle (2014), this one was developed for a management model of the operation of companies based on the theory of the restrictions. The result obtained was a tool that allows the organization to identify and manage the process that is restricting to achieve better financial performance or reduce losses in certain stages of the operation, figure 2.

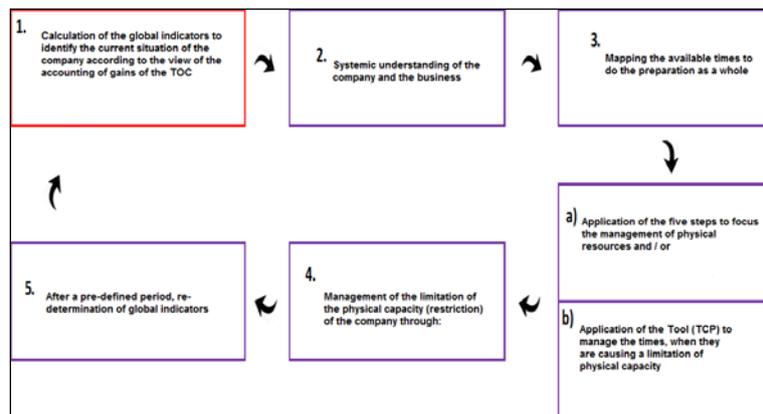


Figure 2: Application of the Toc in Logistics adapted by Follmann

Source: World logistics Magazine (2014), Adapted to English by the authors

2.5. Capacity x Time

According to Caixeta Filho and Martins (2009), the capacity of a system is the measurement of the possible production volumes of this system.

In the case of the capacity of transport systems, it is important to associate it with a certain level of service desired since they are extremely variable. For example, the more congested a terminal, the greater its volume of cargo moved because it is difficult to occur periods of idleness, leading to full use of installed capacity, in contrast, there will be many rows and vehicles will be held for longer and the rush to dispatch them for delivers can cause incidents of shipping errors increase.

In this context, we have the same point of view of Novaes (2001), in which he affirms that the impact caused by the restrictions of time and capacity, is often dramatic since they lead to changes in the solution of the problem due to variations in some factors that govern the process and which are not always well understood when planning a product delivery system.

2.6. Scripting

One of the most important activities of the company is the distribution planning, which is responsible for the adequate delivery to the customers, focusing on the cost, term and quality of service.

Lopes and Melo (2003), describes the routing with a fundamental role in the question of maximization and use of resources. The use of software algorithms in operational research with a cartographic base allows to properly handle the orders and distributed loads even though their totality is random and variable, that is, maximizing and consolidating loads reducing the need for movement.

Identify precisely the fleet profile required by type of vehicle. Identify the best routes that allow reduction of time and distance, saving fuel, preserving natural resources. The best routes suggest the best delivery times allowing great gains in the relationship and maintenance of the customers; termination of the costs involved, especially fuel costs.

Although routing is an important tool for reducing costs and increasing operational efficiency, Lopes and Melo (2003) argue that it depends on some essential factors, including an updated database and modern systems, usually based



on Geographic Information (GIS), which are expensive items and do not always easily adapt to corporate culture.

Still for Lopes and Melo (2003), due to these difficulties, only 5% of freight road transport companies use routing machines, companies that seek a high level of excellence in the service of their customers should seek for new technologies since of course, more and more demanding standards are tapering so that it will stand out in the market that uses all the technologies to monitor the process of delivering products to its greater good that is its customer.

2.7. Casters and Restrictions of Express and Marginal Routes in São Paulo

Implemented in 1997 in the city of São Paulo, the rotation imposes a restriction on the circulation of automobiles between 7am and 10am and from 5pm to 8pm, with the main objective of draining the city's fleet which revolves around the average of 7 million vehicles according to Detran.

According to the Traffic Engineering Company (CET), the estimate is that 20% of the total of the current fleet about 3.8 million vehicles, stop circulating daily in the city due to the rotation.

The city to function needs to allow people to move in their various motives, and also needs to allow the supply of goods and the provision of services. Another measure implemented was in the restrictions of trucking traffic during the hours between 5am and 9am and from 5pm to 10pm Monday to Friday and Saturdays between 10am and 2pm.

The truck drivers have eight hours a day to circulate on the road which represents the working day and allows according to the CET to deliver the products in the city. During the night, there will be seven free hours.

According to CET, the implementation of this restriction aims to reduce occurrences involving trucks, which directly interfere in the traffic at peak times, (Site G1, 2012).

3. METHODOLOGY

According to Barros and Lehfeld (2000), scientific research is the product of an investigation, whose objective is to solve problems and solve doubts through the use of specific methodological and technical processes.



As a method of procedure, the case study which is justified by the observation of an object, for its better understanding and knowledge for this article, the object of study was the HUB operation located in the city of Barueri, in order to know the difficulties in the distribution of fractional loads.

It used the comparative / statistical procedural methods because it involved the investigation of the facts in order to highlight the differences and similarities between the operations starting from the CD of Guarulhos and the HUB in Alphaville, showing quantitatively the superficial costs tied to these two operations, according to Gil (1999), the explanations obtained in the application of the statistical method can not be considered absolutely true, but have a good probability of being true.

According to Triviños (1987), a Case Study as is one of the most relevant type of qualitative research where the author identifies different forms of study including historical-organizational, observational, situational analysis, referring to specific events. And it is classified as follows:

As for nature, it is applied, since it aims at acquiring knowledge for practical application and directed to solutions of the problems raised in research which are focused on two questions related to the optimization of physical space and resources available for operational activities.

We chose the two types of approaches known, quantitative and qualitative.

According to Selltiz (1967), it is an explanatory one, since it aims at identifying the factors that determine or contribute to the occurrence of phenomena, deepening the knowledge of reality for explaining the reason, "the cause" of things. The objective of the research is to identify what are the constraints faced by the HUB in the distribution of fractional loads and the impact on the daily activities of the operation and why they occur. It is also classified as comparative, since the scenarios of the simulations carried out through the software "Road Show", provided several analyzes which were used comparatively between the distribution locations, as well as the variables that directly impact the costs and performance linked to the company operational activities.

As for technical procedures, according to Gil (1999), it is classified as a case study and bibliographic. The research was started from materials already published



about the subject and later focused on the detailed study of the object of research, investigating on the subject to construct new hypotheses or reformulate them.

4. CASE STUDY

4.1. Fortrans

Fortrans Logística e Transportes S/A offer high technology and quality logistics services so that contracting companies do not have to specialize in something that is not part of their core business, performing order management, transportation and coordination of deliveries as well as the development of strategic plans for the entire supply chain.

The company operates throughout Brazil, acting in 184 points with 42 branches. Its premisses are over 650 thousand square meters of built area and patio. More than 5,000 locations served and transporting cargo to 220 countries through RapidEx, certified by ISO 9001 since 1997 with more than 17 thousand active customers, fleet around 3 thousand vehicles and more than 12 million deliveries annually.

4.2. HUB Operation

As the Fortrans company collects and distributes throughout Brazil, for this article, it was decided to restrict the comprehensive research area only to the HUB operation used as a strategic point of distribution and collection of merchandise from B2C clients, Business to Client and B2B, Business to Business.

According to Novais (2001), the HUBs or transit points are widely used as support arm in the distribution of goods or collections, reducing the time and cost, the distribution center of the company Fortrans is located in Guarulhos and the HUB in Alphaville commercial center of the city of Barueri.

The operation works from Monday to Friday from 7:00 a.m. to 9:48 p.m. divided into two shifts, has a small team of 1 lecturer, 3 operators, 1 assistant and 1 assistant who plays the role of leader of this operation since all the results, coordination of this, depend on it.

In short, a Vuc loaded with the goods to be distributed by the HUB, leaves the CD in Guarulhos and arrives at approximately 7:00 am.



The car is unloaded and checked, volume x documentation, the profile of this operation being the fractional load, which is later, separated in the routes, the cars are loaded and the romaneios dispatched for the release of the vehicles. The deliveries are accompanied by the agent that is in the HUB which must ensure that all customers are served at agreed times and deadlines. At the end of the afternoon, a Furgovan collects in the HUB all the packages that were not delivered or that were collected as requested by the Guarulhos branch.

4.2.1. Operational Physical Space

The physical space for this operation was provided by Alphaville's branch, image 1 of the shed's façade, where the production, storage, distribution and after-sales of a particular customer takes place exclusively. It is a branch office located in a small space of only 4,500 square meters and has only 3 docks for loading and unloading, where 1 of them was assigned to the HUB operation of the Guarulhos branch, as picture 1, third dock from left to right.



Photograph 1: Front of the Alphaville branch where the HUB operation is located
Source: Fortrans

All procedures related to the safety and release of vehicles in and out of the Alphaville branch. Although the space provided for the operation of Guarulhos is of all the extension of a dock, part of it is occupied by boxes of the operation of a determined client, which has space preference, it is possible to verify such information, observing the boxes with Logo in red and pallets with cardboard boxes disassembled according to photograph 2.



Photograph 2: Entry of the loading and unloading dock of the HUB operation
Source: Fortrans

It has been observed that these volumes end up disturbing the little space for unloading, checking and separation of incoming loads, in some cases material wrongly routed for this reason. In photograph 3, it is possible to observe how much space these materials occupy.



Photograph 3: Boxes with red and blue colors and stacks of dismantled boxes
Source: Fortrans

The yellow cage, photograph 4, and other volumes belong to the HUB, in this "cage" are allocated the highest value and / or theft volumes, such as electronic products, operators and lecturers are responsible for the key and movement of these materials, However, all volumes of high added value should be considered, since in the case of theft the employees must respond for this lack. Larger volumes are palletized in an attempt to hinder potential losses.



Photograph 4: Frontal image of the dock boundary and part of the "cage" to allocate high

Source: Fortrans

In Photograph 5, as mentioned above we have the limiting part of the warehouse assigned to the HUB and the previous storage of part of the volumes that were collected that will be transferred at the end of the day to the Guarulhos branch.



Photograph 5: Dock entrance after unloading.

Source: Fortrans

4.2.2. Fleet

The vehicles, drivers and helpers of this operation are aggregated and responsible for all deliveries and collections in the regions of Osasco, Carapicuíba, Alphaville, Barueri, Santana de Parnaíba, Pirapora, Itapevi, Jandira, Cotia, Vargem Grande Paulista, Caucaia do Alto, Juquitiba, São Lourenço da Serra, Taboão da Serra, Embu Guaçu, Embu das Artes and Itapeçerica da Serra, Cajamar, Franco da Rocha and Francisco Morato.

The main collection clients are concentrated in the regions of Alphaville, Barueri, Osasco and Carapicuíba and Itapevi. The fleet is composed of 10 cars, including Vuc, Van and Fiorino and may have a vehicle of its own eventually but the request must be pre-programmed.

Vuc: The Vucs are used in the transfer of large amounts of cargo; they are the ones that carry to the HUB all the packages to be delivered in the regions served by this operation and mainly in the collection in the B2B clients, after their complete unloading giving the operation greater mobility with an expressive amount of cargo support.

However, in some customers they are restricted by height and cannot enter the place of loading and unloading of the company. These customers are already known for the operation, however, in cases of large volumes to be collected in a single customer and not being able to send a truck, it is necessary to make several trips to collect the orders of the customers.

Van or Furgovan: The vans take care of the operation very well because its load capacity is great, the height generally does not prevent to enter the interior of condominiums and commercial warehouses, it is very used in the operation to attend mainly the deliveries in malls where the large number of delivery products is from the Asics customer, their volumes are cubic boxes that take up a lot of space often in a single delivery, there may be more than 12 volumes for the same customer.

Fiorino: It was observed that although it does not have the capacity to allocate large volumes, Fiorino is the vehicle that seems best to meet the needs of the HUB because if it had a large amount of small boxes and / or packages destined to customers B2C. The most common products are cell phones, watches, electronics and Apple products.

Own Car: According to observations and reports made by employees of the company, the car itself is only available in cases of urgency, that is for deliveries of priority customers such as Apple, Dell or in cases where the expected delivery period has expired and the delivery must be performed in order not to affect the performance of the Guarulhos branch or even for deliveries in distant regions which is not profitable for the added driver. Still reported by employees, the affiliate does not leave a car fixed in the HUB because this car is not needed every day.

4.2.3. Costs and Profitability

A spreadsheet, table 1, with the descriptions of the values of the daily costs of each aggregate vehicle, amount paid per helper, cost of the 2nd exit for delivery and / or collection, overnight value, among other information was made available for the



case study which the assistant of this operation should be based in order to optimize the vehicles, cost reduction in addition to the restrictions of each operation or customer. However, this reference is little used in practice, as observed in the field.

Table 1: Values of Added Vehicles

Values of Fiorino		
Daily	R\$	110,00
2nd exit	R\$	88,00
Daily Half - When This Route	R\$	55,00
Helper	R\$	45,00
Overnight stay	R\$	120,00
Variable by Event	R\$	10,00
Values of Furgovan		
Daily	R\$	160,00
2nd exit	R\$	128,00
Helper	R\$	45,00
Daily Half - When This Route	R\$	80,00
Overnight stay	R\$	120,00
Variable by Event	R\$	11,50
Values of WJC's		
Daily	R\$	180,00
2nd exit	R\$	144,00
Helper	R\$	45,00
Daily Half - When This Route	R\$	90,00
Overnight stay	R\$	120,00
Variable by Event	R\$	11,50
Ratio of Daily Trucks - Carts		
Daily	R\$	310,00
2nd exit	R\$	248,00
Overnight stay	R\$	120,00
Barueri, Santo André, Cajamar, SBC e Itapevi	R\$	350,00
Embu, Santana de Parnaíba, Mauá e Tamboré	R\$	350,00
Jundiaí, Operações Apple e Fast Shop	R\$	500,00
De 11 Hortolândia, Louveira, Sumaré, Cabreúva, Jaguaruna/Motorola	R\$	650,00

Source: Data of internal material Fortrans.

The value in cargo freight should be more than double the daily rate of the vehicle, for example, the daily rate of a Fiorino is R\$ 110,00, the freight value in cargos must be higher than R\$ 220,00 for the company can obtain some profit / profitability in freight.

4.2.4. Operational Restrictions

Many constraints were observed in relation to deliveries by customer requirement or force majeure, such as:

Size of the vehicle: some customers already delimit the size of the collection vehicle by informing previously in the schedule the type of material for the removal of the material, this facilitates the programming of the car and the number of employees that will be sent for collection of the loads but not all the customers act in the same way, thus causing variable and often dramatic situations for the leader of this operation who must at the last minute locate and make available another car to collect

all the material requested by the customer or have to request that the vehicle perform a second trip to meet demand. The reverse may also occur.

Customer locations, especially for clients in the Alphaville region, Barueri city's commercial center, many of them do not have their own parking, the driver has nowhere to park the vehicle without the risk of taking a ticket or having some inconvenience during collecting like having to stop the vehicle at any location and making multiple trips with the cart until collecting all the material, this takes time, rework and generates greater physical wear and tear of the employee.

Permanence of collaborators in the place, still to emphasize the delicacy of the previous situation, many of the clients do not authorize the entrance of helpers in the place and all the work ends on the account of the drivers.

Optimization of the vehicle to make collections and deliveries, either by requirement of some customers who do not accept that the car that will perform the collection is previously loaded by the route to be met or scheduling, it is not always possible to reduce costs by taking advantage of the same car of delivery for collection, it is recurrent the sending either to the same client or near address to send a car only to carry out the collection and another one for delivery.

Priority customers, Apple, Dell, Nokia deliveries, Motorola picks, Netshoes, Walmart, daily scheduled deliveries among others. With these customers the company can not fail because the level of service agreed revolves around 95 and 98%, case of Apple and Dell, that is, for these customers there can not be any failures in the operation and if any unforeseen happens should be immediately standardized because they pay to have the best possible operational performance and priority in road or air mode operations.

5. FIELD ANALYSIS

The data collected refer to the sample of a common demand day of the HUB operation. These data were organized in spreadsheets in Excel, for this article we will focus only on the operations of deliveries and parallel analyzed based on the references raised in bibliographical researches and problems pointed out.

Subsequently, solutions were proposed that aim to optimize the separation and distribution of the goods executed by the HUB, as well as the best use of the physical operating space.



Simulations were carried out based on the data collected through the Road Show software allowing several unfolding scenarios of the HUB operation where applications of techniques and acquired knowledge were essential for the analysis of the results and proposed solutions.

According to Rodrigues (2005), logistics must be applied to harmonize the supply, demand, production and distribution of a product with the objective of reducing costs; all the definitions revolve around the concept of always increasing the level of service to the customer and reduce logistics and transportation costs for the company.

The lack of planning in the operational flow from the arrival of the transfer vehicle coming from the Guarulhos branch, the effective distribution of the volumes, Ballou (2010, p.24) states that: "[...] transportation is the most important logistic activity simply because it absorbs, on average, one to two-thirds of logistical costs. "

The author further compliments the matter by saying that no modern company can operate without moving its goods.

Thus, through the opinions of the authors and experts in the segment of logistics and distribution, it was found that Fortran operates through the hybrid mode of distribution but uses the incorrect method as a flow process, since in a transit point or HUB the volumes are not stored in the warehouses as the deliveries have previously known destinations, the cargo is consolidated from the CD or Guarulhos branch and goes straight to the HUB with the sole aim of being fragmented and distributed with agility.

5.1. Analysis of the Demand for Deliveries

The demands of deliveries related to the time closest to the day-to-day reality of the operation were simulated where the interval criterion of 15 minutes was used for each delivery; table 2 provides the data collected as a basis for the simulations that were performed.



Table 2: Data Relating to a Day of Demand for Deliveries

Route	Location	Quantity of Deliveries	Number of vehicles on the Route	Business Hours
1	OSA SCO CARAPICUÍBA	15	1	10 hrs
	BARUERI	15		
2	SANTANA DE PARNAÍBA	10	1	10 hrs
	PIRAPORA DO BOM JESUS	2		
	JANDIRA	8		
3	ITAPEVI	8	1	10 hrs
	COTIA	5		
	VARGEM GRANDE PAULISTA	4		
	COTIA - (CAUCAIA DO ALTO)	5		
	TABOÃO DA SERRA	12		
4	EMBU DAS ARTES	5	1	10 hrs
	ITAPECERICA DA SERRA	5		
	EMBU GUAÇU	5		
5	POVILHO	5	1	10 hrs
	JORDANÉSIA	5		
	CAJAMAR	5		
	CAIBRAS	5		
	FRANCISCO MORATO	5		
	FRANCO DA ROCHA	5		
TOTAL		159	5	10 hrs

Source: Internal material data Fortrans

For Lopes and Melo (2003), the routing of deliveries plays a fundamental role when it comes to maximizing the use of transport resources considering the use of software with powerful operational research algorithms applied to a complete cartographic base and updated, allowing to treat all the orders and loads to be distributed even if they are totally random and variable.

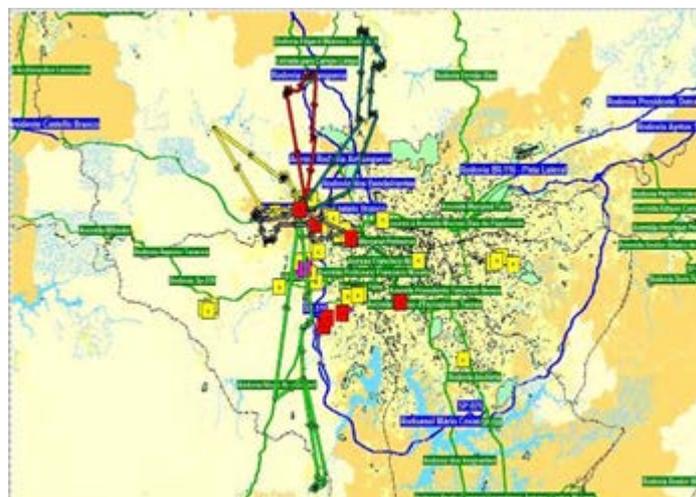


Image 1: Simulation Result Using Roadshow Software - Deliveries

Source: Routing

In the current scenario of the operation we obtained the following results, as shown in image 1. Each colored dash on the map corresponds to a route from table 2, the small squares in yellow, red and pink, correspond to deliveries not made on the day, due to the excess hours worked meaning that the drivers arrived at the time limit allowed for deliveries the equivalent of a 10-hour workday and that such customers did not receive their orders.

This explains the fact that the warehouse is full of volumes when it should not since it does not characterize the behavior of a HUB or transit point operation, this assertion goes against Novaes regarding this method of distribution:

Transit Point: Similar to CDs with the differential of not maintaining inventories, they are located in order to serve a specific market area, away from the central warehouses and operate as transit facilities, receiving consolidated cargoes, separating them and distributing fractions for local deliveries near the region in which it is allocated. The main feature is that the fractionated loads already have a known destination, speeding up the deliveries and making possible the advance planning of the routes (NOVAES, 2001 p.236-240).

By organizing the map data for a better understanding of the scenario we have the following results expressed in table 3.

Table 3: Simulation Data Analysis of Deliveries

Route / Color	Exit Time	Quantity of Deliveries	Arrival Time	Deliveries Made	Km Traveled	Expected	Realized
1. Grey	08:00	30	19:00	21	76,61	19	13
2. Yellow	08:00	42	19:00	18	84,41	26	11
3. Turquoise	08:00	30	19:00	14	129,15	19	9
4. Green	08:00	27	19:00	21	59,47	17	13
5. Red	08:00	30	19:00	17	109,60	19	11
		159		91	459,24	100%	57%

Source: Elaborated by the authors - Result of the simulations carried out through the software Road Show.

It is clear that the performance of daily demand is not satisfactory for the delivery operation and that many customers do not receive their packages on the expected date. To be more exact, these account for 68 or 43% of customers dissatisfied with the services provided by the company Fortrans.

For Alvarenga and Novaes (2000), freight transport linked to quality in services has made the efficiency of the logistics system a basic condition for competitiveness in all sectors of the country's economy. Transportation is the logistics activity

responsible for making the connection between production and demand, taking goods and services as far as the final consumer is at the time needed and in the desired physical conditions.

Nowadays, we have in addition to the highly competitive and demanding market, customers who know their consumer rights well and who have tools such as the Internet and social networks to express their opinions about products and services purchased, which can instantly lead to a company to "glory or bankruptcy".

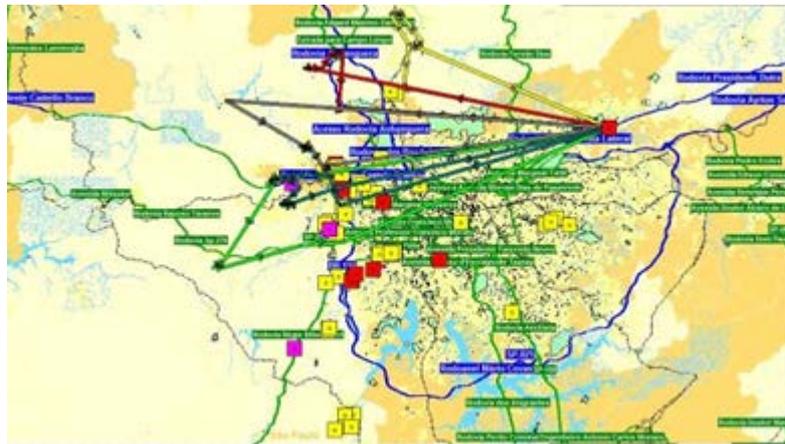


Image 2: Simulation of the Demand of Deliveries Starting from Guarulhos
Source: Routing

Comparing the two scenarios, it was noticed that there is a 10.5% difference index related to the performance of deliveries, between Guarulhos and Alphaville, where HUB is the best option for this case, since 17 more customers would be served if the deliveries left Guarulhos.

5.2. Optimizing Results

Exploring the route simulator tool, Road Show, we asked this software to optimize the results considering that all deliveries and collections of the day, according to the sample of data collected should be carried out within a maximum period of 8 hours, the tables that follow in this item had as objective to analyze such obtained answers.

For the cargoes coming from Guarulhos we had image 3 illustrating with colored outlines the delivery routes. As it became difficult to identify each color, we call the routes by numbers from 1 to 20, having as orientation the top to bottom direction of the map.



Image 3: Optimum solution for the Delivery Routes Starting from the Guarulhos CD
 Source: Routing

We measured the results of the simulation in table 4 where the first detail to draw attention to us was the quantity of cars required for deliveries to be made within 8 hours of work, which is certainly not adequate for this operation, since the aim is to reduce costs.

It was also verified that 50% of the cars would return before the 13 hours for company, all would leave with a minimum number of deliveries and to work with own fleet in this scenario would be a huge loss for company and no aggregated driver would accept to leave only with 8 deliveries as they begin to make a profit from the 10th delivery performed where they receive an additional amount for each delivery made.

Table 4: Results of the Simulation Using as Criteria 8hrs of Working Day, GRU.

Route	Exit Time	Number of Deliveries	Worked Hours	Arrival Time	Km Traveled	Realized
1.	08:00	8	04:49	12:49	123,76	0,05
2.	08:00	8	05:09	13:09	123,76	0,05
3.	08:00	8	05:40	13:40	149,43	0,05
4.	08:00	8	06:02	14:02	187,65	0,05
5.	08:00	8	06:34	14:34	130,44	0,05
6.	08:00	8	07:56	15:56	109,60	0,05
7.	08:00	8	06:03	14:03	142,80	0,05
8.	08:00	8	07:23	16:23	172,36	0,05
9.	08:00	8	05:38	13:38	142,43	0,05
10.	08:00	8	06:20	14:20	173,49	0,05
11.	08:00	8	04:45	12:45	125,29	0,05
12.	08:00	8	03:44	11:44	126,58	0,05
13.	08:00	8	04:40	12:40	125,13	0,05
14.	08:00	8	07:53	16:53	123,03	0,05
15.	08:00	8	05:03	13:03	122,47	0,05
16.	08:00	7	04:40	12:40	157,56	0,04
17.	08:00	8	04:05	12:05	105,65	0,05
18.	08:00	8	05:22	13:22	157,31	0,05
19.	08:00	8	03:52	11:52	127,70	0,05
20.	08:00	8	04:13	12:13	113,54	0,05
Total		159	109:51		2740,01	100

Source: Elaborated by the authors - Result of the simulations carried out through the software Road Show

Table 5: Simulation Results Using 8hrs of Working Day Criteria, HUB.

Route	Exit Time	Quantity of Deliveries	Worked Hours	Arrival Time	Km Traveled	Realized
1.	08:00	12	06:36	14:36	139,61	0,08
2.	08:00	16	07:47	15:47	106,86	0,10
3.	08:00	13	07:28	15:28	126,98	0,08
4.	08:00	3	01:44	09:44	15,29	0,02
5.	08:00	8	06:13	14:13	12,96	0,05
6.	08:00	18	07:25	15:25	70,73	0,11
7.	08:00	12	07:39	15:39	72,42	0,08
8.	08:00	11	06:50	14:50	89,08	0,07
9.	08:00	18	08:05	16:05	84,41	0,11
10.	08:00	19	07:13	15:13	47,96	0,12
11.	08:00	7	01:58	09:58	29,77	0,04
12.	08:00	8	03:21	11:21	68,80	0,05
13.	08:00	8	03:28	11:28	14,40	0,05
14.	08:00	6	02:47	10:47	31,95	0,04
Total		159	78:38		911,21	100

Source: Simulations made through Road Show software

5.3. Is Physical Space Appropriate?

The physical space is poorly utilized, thinking about it a replanning was done verticalizing the storage of volumes, using the pallets, allowing the operation to gain movement, speeding up the loading and unloading activities and thus adapted to receive and allocate in an organized manner, the deliveries 1 day before its distribution, according to figures 3 and 4:

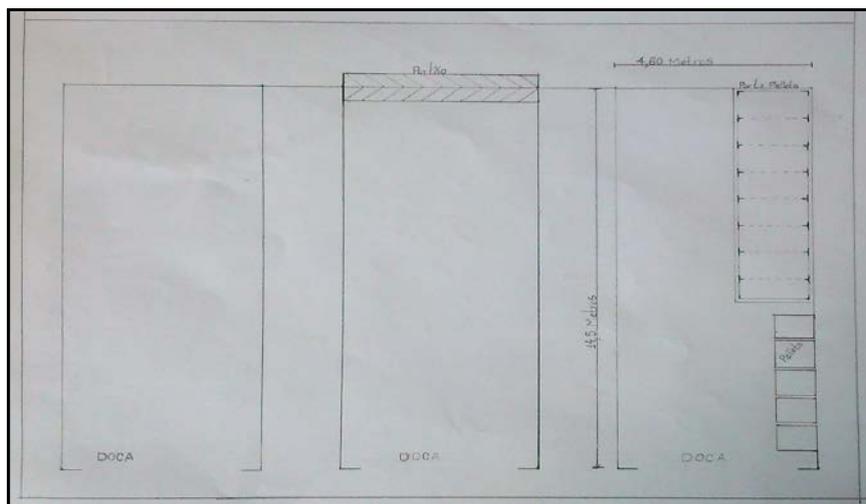


Figure 3: Replanning of the physical space - floor plan
 Source: Prepared by the authors

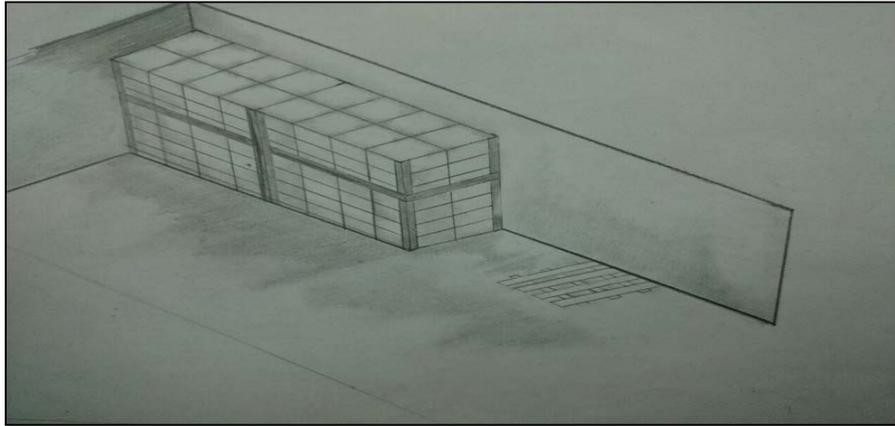


Figure 4: Replanning of the Physical Space - Upper Plant
Source: Prepared by the authors

With the new layout and rearrangement of the operational flow, it is unnecessary to increase the fleet since the amount of volumes demanded for the HUB daily is low and the availability of the fleet which will be sufficient to supply the needs of the operation without necessary to tow more vehicles and keep in line with management objectives related to cost reduction and optimization of available resources.

The bottlenecks will be diluted in the short term by the time the leader of the operation will gain to plan how much and when the volumes demanded will leave for the deliveries allowing even a redesign of the days and which localities to be met versus days of the week, according to daily demand, allowing the visibility and forecast of delivery, opening the opportunity to create a channel of information for the customer regarding its delivery in addition to making the CD of Guarulhos have visibility of the volumes stored enabling the control of the performance of the HUB operation which was not performed in the old scenario.

The new layout will also help the collected volumes not to be mixed with the ones that will be distributed, avoiding delays caused by operational errors.

5.4. What is the Real Impact of Restrictions Raised on Research?

The perception we had was that the restrictions are external, such as vehicle plate rotation and traffic schedules or internal restrictions such as scheduling schedules, priority customers, do not affect the operation as much as the lack of planning and strategies for the distribution and collection of volumes.

The operations assistant has no technical knowledge or is not implemented in the day to day operation and the lack of support of the CD of Guarulhos when it comes to sending a car from the house to assist in some deliveries is precarious and the result of this could not be different, the company loses in performance, loses in quality in services, loses in costs, since there is no pro-activity in optimizing what is available or the lack of vision for these resources, which end up getting very loose and dependent on a good management.

According to Rodrigues and Mayerle (2014), logistics presents strategies to leverage the company's business through improvements in the management of processes related to the movement and storage of materials and the corresponding information. With efficient management, a company can be managed with fewer resources and costs, thereby obtaining a better return on invested capital.

The theory of constraints applied to logistics contributes to the identification and improvement of bottlenecks as a method of systemic management which aims at correcting anomalies identified in the operational flow, we applied the ToC, Theory of Constraints

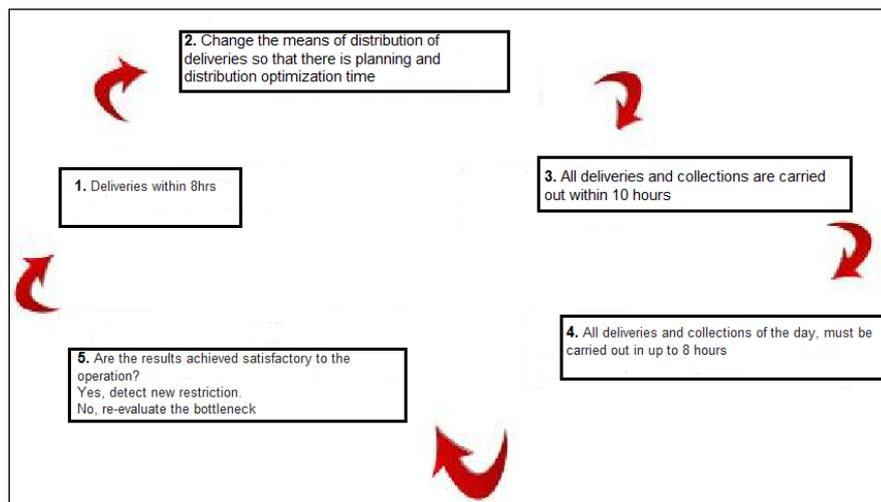


Figure 5: ToC - Theory of Restrictions Applied to HUB Operation, having as constraint the operating time bottleneck of 8 hours for execution of demands.

Source: Prepared by the authors

Applied to the HUB operation, having as a constraint, great time, the work day limited in 8 hours daily which ensures that customers will be served within business hours.

With the correct use of this tool, the constraints are easily identified and improved preventing greater impacts on the performance indicators results.

6. CONCLUSION

It was considered that the study carried out in the company Fortrans is of great value to increase the knowledge of students and employees of the company itself, besides emphasizing the importance of good management that is related to the fleet, people or activities. The technical knowledge in line with daily experience and business knowledge effectively collaborate in reducing costs; gain in operating time and activities and especially in the final results which can be measured by a significant feedback from the company: its customers.

The theoretical framework approached gave us the opportunity to better evaluate the issues raised in the field since we brought experts and renowned authors in the subject to base our analyzes, in addition to all the context studied during the Technology in Logistics course which allowed us to identify many examples discussed in the classroom and in day-to-day situations in the companies we work with.

The simulations carried out using the Road Show software, kindly provided by the company Routing enriched the analyzes performed providing simulations with several variables and scenarios and proved that the HUB operation is pertinent to Alphaville, where there is a leaner operation with reduced costs and labor besides fulfilling the function, it proposes to expedite the deliveries and collections demanded for this operation.

However, changes were necessary for the operation to flow in a desirable manner, for which, some changes were suggested so that these results could be achieved without changing costs, such as layout changes which started to gain movement and organization to streamline and behave properly its functionalities which respond positively to the questions raised in research and match the hypotheses.

The correct reading of the mode and means of distribution, directly affected the results, passing from transit point, where the loads should not be stored previously for their distribution and should behave fluently but this did not occur in the HUB operation that caused bottlenecks and delays due to the lack of planning in the volume distribution. With the re-reading of the scenario it was proposed that the company adopt the means of cross docking distribution where the cargo is stored for



a short time, that is, this lead time provides the correct volume distribution planning according to demand and agreed deadlines .

The transfer of delivery loads arriving in the transfer vehicle allowing the delivery routes to be planned for distribution, according to the physical space of the cars, delivery times and regions to be served, so that time, space and costs are optimized in the distribution of goods, guaranteeing the company's credibility and customer loyalty;

Despite the optimal results of the simulations, they do not satisfy the basic operating principles of keeping costs down and operating only with the available resources. There was an increase in the number of cars in the fleet which does not correspond to the objective, however, redesigning the layout and distribution loads arriving the day before will allow the leader of the HUB operation to plan the distribution favoring the optimization of available resources, discarding the possibility of increasing the fleet to meet daily demand, which will be observed in the short term with the dissolution of bottlenecks.

It was also observed that external constraints do not affect so much when one has a good planning, knowledge and creativity to deal with these Hindrances, in the same way was observed with respect to the internal restrictions.

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