

# Planning Coordinated Loads To Facilitate Centralized Dispatching In The Grocery Industry

by

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Bachelor of Science, Operations Research & Industrial Engineering  
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Submitted to the Engineering Systems Division in Partial Fulfillment of the  
Requirements for the Degree of

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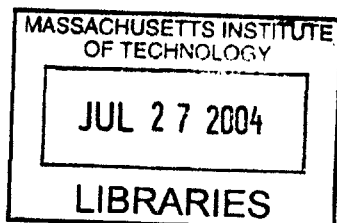
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## **ABSTRACT**

As economies grow and companies seek increasing market shares, they must also build the infrastructure within their organization to support that growth. In the grocery business in particular, there are many challenges associated with fleet management and the opportunity to centrally manage the entire fleet is viewed as a cost and time-savings opportunity

This project was conducted in partnership with a grocery retailer with the goal of examining several elements of the companies transportation system and processes with two goals in mind. The first goal was to look for opportunities to reduce cost, total miles traveled, and total empty miles traveled by the fleet. The second goal was to examine current processes and start to determine what changes or approaches should be recommended in pursuit of a central dispatching function to coordinate all movements within the transportation network.

For this particular retailer, several areas were identified as potential stepping stones in its plan to begin a central dispatching operation. These areas of opportunity include using third party carriers for store deliveries, planning routes to increase the level of coordination between inbound and outbound transportation, and using the retailer's private fleet to provide carrier service for other shippers.

Analysis projected that using third party carriers for outbound store deliveries could save the organization a significant sum of money, more than 1% of annual freight costs. Overall, there are many opportunities to take advantage of network characteristics to improve overall efficiency, reducing total cost and total empty miles traveled; they are discussed in detail.

## ACKNOWLEDGEMENTS

I would like to thank my advisor, Chris Caplice, for his guidance throughout this year at MIT, as well as Professor Dennis Reynolds for always pointing me in the right direction.

Thanks also to my thesis advisor, Jarrod Goentzel for his insight and suggestions. In late December when this work began to get underway, my project partner Arzum Akkas and I were unsure how the project would unfold. Since then it has been a good journey and I think we've both learned a great deal, it has been a pleasure to work with her.

To Ed Rodricks and his colleagues at the retail chain which partnered with MIT for this project, I thank you for your unending assistance and willingness to educate a couple of students about your industry. We've learned a lot and I hope you've enjoyed the experience as much as we have.

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## Table of Contents

<b>Chapter 1: Thesis Overview and Background of Grocery Operations .....</b>	<b>7</b>
Section 1.1 Introduction.....	7
Section 1.2 Thesis Outline .....	8
Section 1.3 Grocery Operations .....	9
Section 1.4 Transportation Operations.....	10
Section 1.4.1 Transportation Metrics .....	11
Section 1.4.2 Transportation Management Systems .....	13
Section 1.4.3 Operating Costs In Food Industry Transportation Operations.....	14
Section 1.4.4. Trends and Benchmarks in Food Industry Distribution in the US.....	15
<b>Chapter 2: Current Operations.....</b>	<b>20</b>
Section 1: ABC.....	20
Section 2: ABC Supply Chain .....	21
Section 2.1: ABC Stores & Distribution Centers .....	21
Section 2.2: YZ Distribution Centers.....	22
Section 2.3: Network Clarifications:.....	23
Section 2.4: Transportation.....	24
Section 2.5: Carrier Utilization .....	29
Section 3: Operational Processes & Information Systems .....	30
Section 3.1: Ordering – Non-Perishables .....	30
Section 3.2: Ordering – Perishables .....	30
Section 3.3: Ordering Process - Inbound .....	31
Section 3.4: Ordering Process - Outbound.....	32
<b>Chapter 3: Third Party Carriers for Outbound Deliveries.....</b>	<b>37</b>
Section 1: Background.....	37
Section 2: Constraints .....	37
Section 3: Planning.....	39
Section 4: Analysis .....	42
Section 4.1: Estimating Costs: Private Fleet .....	42
Section 4.2: Estimating Costs: Wholesale Supplier YZ.....	43
Section 4.3: Estimating Costs: Third Party Carriers .....	44
Section 5: Implementation .....	55
<b>Chapter 4: Process Planning With Backhauls.....</b>	<b>58</b>
Section 1: Background.....	58
Section 2: Constraints .....	59
Section 3: Planning.....	60
Section 3.1: Static Routes .....	60
Section 3.2: Central Dispatching/ Dynamic Routes .....	64
<b>Chapter 5: Private Fleet as a Carrier for Other Shippers.....</b>	<b>66</b>
Section 1: Background.....	66
Section 2: Constraints .....	67
Section 3: Planning & Analysis .....	67
Section 4: Implementation .....	69
<b>Chapter 6: Integration and Central Dispatch .....</b>	<b>72</b>
Section 1: Benefits of Integration .....	72

<b>Appendix A – Glossary of Terms .....</b>	<b>78</b>
<b>Appendix B – Glossary of Systems .....</b>	<b>79</b>

**List of Figures**

Figure 1: Transportation Cost Breakdown .....	15
Figure 2: Food Industry Trend Report Survey Respondents .....	16
Figure 3: Distribution Centers .....	22
Figure 4: RGPF Assets by Location .....	25
Figure 5: Outbound Carrier Movements (% of Total Outbound).....	27
Figure 6: Inbound Carrier Movements (% of Total Inbound).....	29
Figure 7: Inbound Order Process Information Flow .....	32
Figure 8: Outbound Order Process Information Flow.....	33
Figure 9: Information Flows Through the Transportation System (Top Half).....	34
Figure 10: Information Flows Through the Transportation System (Bottom Half) .....	35
Figure 11: RGPF Route .....	43
Figure 12: RGPF Route Miles Calculation Explanation .....	43
Figure 13: Third Party Carrier Outbound Route .....	45
Figure 14: Sensitivity of Carrier Choice to Stops Per Load.....	54
Figure 15: Process Flow Chart - Incorporating Third Party Carriers for Outbound Deliveries (Top Half).....	56
Figure 16: Process Flow Chart - Incorporating Third Party Carriers for Outbound Deliveries (Bottom Half) .....	57
Figure 17: Process Map – Route Planning With Backhauls (Top Half).....	62
Figure 18: Process Map – Route Planning With Backhauls (Bottom Half) .....	63
Figure 19: Planning Dynamic Routes to Incorporate Backhauls .....	65
Figure 20: Process Flow - Private Fleet Acts as Shipper (Top Half) .....	70
Figure 21: Process Flow - Private Fleet Acts as Shipper (Bottom Half).....	71
Figure 22: Centralized Transportation Planning Information Flows.....	74

## List of Tables

Table 1: TMS Vendors .....	13
Table 2: Key Performance Indicator Trends.....	17
Table 3: Outbound Transportation-related Expenses (in percentages of total sales).....	20
Table 4: Distribution Center Management and Functionality .....	23
Table 5: Carriers .....	24
Table 6: YZ Upcharge Rate Detail .....	26
Table 7: Outbound Movements by Carrier (% of Total Outbound) .....	27
Table 8: Inbound Movements by Carrier (% of Total Inbound) .....	28
Table 9: Approximate Average Weekly Total Carrier Movements .....	29
Table 10: RGPF Outbound Cube Utilization.....	30
Table 11: RGPF Inbound Cube Utilization.....	30
Table 12: DC Characterization .....	40
Table 13: Third Party Carrier Inbound Lanes to ABC's DC.....	47
Table 14: Third Party Parameters .....	48
Table 15: Third Party Calculations .....	49
Table 16: Third Party Carrier For Outbound – Sample Potential Savings .....	51
Table 17: Possible Routes.....	68

# **Chapter 1: Thesis Overview and Background of Grocery Operations**

## ***Section 1.1 Introduction***

As economies grow and companies seek increasing market shares, they must also build the infrastructure within their organization to support that growth. Historically, when a company that owns its private truck fleet expands its business, it often grows the fleet, and acquires additional terminals. As the size of the business and scale of operations increase, the efficient coordination of loads throughout the entire network becomes more difficult. In some companies with multiple truck terminals, an operational decision has been made to centralize the coordination and dispatching of all transportation movements within the network.

In the grocery business in particular, there are many challenges associated with fleet management and the opportunity to centrally manage the entire fleet is viewed as a cost and time-savings opportunity. One of the daily challenges involved in fleet management in the retail grocery business is the efficient management of ordering processes, both of inbound products from vendors and outbound to retail stores. Likewise the transportation managers within the organization must coordinate the daily delivery of products from vendors to their distribution centers, as well as the loads of groceries outbound to stores, from 3 to 7 times per week for each store.

Once loads are created and the demand for truck resources is known, drivers and resources (tractors plus dry and refrigerated trailers) are dispatched to pick up and drop off the loads within the network. For some combinations of location and cost factors, third party carriers are also used for both inbound and outbound transportation and some vendors deliver they own products direct to the grocer's distribution centers. These loads must also be efficiently coordinated within the network.

The grocery business is a high-volume, low-margin industry which can benefit, through economies of scale, from many seemingly small cost reduction opportunities. In the management of a retail grocery fleet, there is much room to look for improvements in processes which would yield greater efficiencies and cost savings. In particular, this thesis will examine methods to effectively coordinate inbound and outbound loads, as well as the efficient matching of fleet resources to these loads.

### ***Section 1.2 Thesis Outline***

The grocery retail partner for this thesis project currently operates with three terminals, one each at its two DCs and one cross-dock facility. The organization knows it can improve the efficiency and costs associated with transportation and strives to centralize dispatching operations to realize these savings. To fully investigate the challenges and benefits associated with centralized dispatching, the project was split into two parts which will be the key components to formulating a central dispatch operation.

The first component of the project is to focus on methodologies to generate coordinated loads within the network of the retailer, its suppliers, and its approximately 200 stores. This effort will look at several transportation opportunities within the network, considering the private fleet, the fleet of its wholesale supplier and third party carriers. One area of focus will be on the coordination of inbound and outbound loads to minimize the number of empty miles driven within the network. This part of the project will be described in detail in the thesis titled Planning Coordinated Loads to Facilitate Centralized Dispatching in the Grocery Industry, written by Nancy Archambault.

The second half of the project will involve the efficient assignment of resources to the coordinated loads. The focus of the project will be to establish a process which determines the

appropriate quantity and scheduling of resources needed to satisfy transportation needs over an entire year (through all seasons). Good fleet management is more than determining the optimal route from point A to point B, it involves managing the daily functions of assigning and dispatching drivers and equipment within constraints such as DOT regulations and customer time windows. The costs of these resources are substantial; driver costs can comprise up to 60% of total transportation costs, so investigation of methods to improve these processes can yield appreciable savings. This part of the project will be described in detail in the thesis titled Transportation Resource Scheduling in the Grocery Industry, written by Arzum Akkas.

### ***Section 1.3 Grocery Operations***

Supermarkets have traditionally played the role of consolidating a wide assortment of grocery items and then distributing them conveniently close to consumers. Grocers strive to maintain a clean, well-lit environment for customers to peruse an assortment of products and choose the groceries they need to nourish their families. Retail grocers have the responsibility of procuring produce, meat, dairy, frozen and other dry grocery products from suppliers throughout the country. The retailer must then coordinate the transportation of these groceries from the suppliers to its own distribution centers, and from these distribution centers to retail stores. Within the stores, grocery items must be displayed in an appealing manner, and the quality and freshness of each item must be ensured throughout transportation, storage, and its time on the shelf.<sup>1</sup>

More recently, the dominance of discount retail outlets in the United States, as well as the increasingly wide variety of consumer tastes, have forced retail grocers to stock an increasing number of SKUs. As a result, retail grocer's find themselves in a position where they need to

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<sup>1</sup> Dr. Edward A. Brand, *Modern Supermarket Operation*, Fairchild Publications, Inc. New York, 1963.

devote tremendous attention to the efficient and cost-effective management of their transportation network and resources.

### ***Section 1.4 Transportation Operations***

Transportation is a key decision area within logistics management. If the cost of purchased goods is excluded, transportation costs typically range between one-third and two-thirds of total logistics costs.

Inbound transportation in the grocery industry refers to the movement of merchandise from the source of supply to the distribution centers. Outbound transportation is the process related to the movements of the merchandise from the suppliers or the distribution centers to the supermarkets.

Below are some of the decision areas in daily transportation operations:

#### **Carrier Choice**

Companies with products to ship need to determine the appropriate strategy to ship loads within the network. Some organizations choose to operate their own fleet of vehicles to move loads, while others outsource all trucking needs to outside carriers. Between these two extremes, there are many possible mixes of carrier choices which could minimize total transportation costs. Some of the key factors in choosing a carrier involve: operating lanes, cost per mile, total cost, and quality and reliability of service.

#### **Vehicle routing**

Vehicles are routed within the network with the goal of reducing transportation costs and improving the customer service. Routes are created by finding the best paths that a vehicle

should follow through a network of roads, rail lines, shipping lanes, or air navigational routes that will minimize time or distance is a frequent vehicle routing decision problem.<sup>2</sup>

### **Vehicle routing and scheduling**

Vehicle routing and scheduling in the grocery industry is an extension of the traditional vehicle routing problem. More realistic restrictions are now included such as:

- Each stop may have loads to be picked up as well as delivered (routing inbound & outbound vehicle movements together)
- Multiple vehicles may be used which have different capacity limitations for both weight and cube (volume)
- A maximum total driving time is allowed on a route before a rest period of at least 8 hours (due to company regulations or U.S. Department of Transportation safety restrictions)
- Stops may permit pickups and/or deliveries only at certain times of the day (called time windows)
- Pickups are permitted on a route only after deliveries are made
- Drivers may be allowed to take short rests or lunch breaks at certain times of the day

### **Scheduling Driver Assignments**

There is a separate problem, one step beyond basic vehicle routing, called a driver assignment and scheduling problem. Driver assignment and scheduling is the matching of the right driver to the right load in a sequence of tasks (deliveries) over time, considering the constraints of labor rules, customer windows, and transportation regulations.

### **Section 1.4.1 Transportation Metrics**

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<sup>2</sup>Ballou, Business Logistics Management, Prentice Hall College Div, 1992.

To measure performance within transportation operations, a variety of metrics are used.

Some of the most widely used metrics are described below.

- Freight cost per unit shipped: Calculated by dividing total freight costs by number of units shipped per period.
- Cost per mile: Calculated by dividing total freight cost by total mileage made per period.
- Outbound freight costs as percentage of net sales: Calculated by dividing outbound freight costs by net sales. Percentage can vary with sales mix, but it is a very good indicator of the transportation financial performance.
- Inbound freight costs as percentage of purchases. Calculated by dividing inbound freight costs by purchase dollars. The measurement can vary widely, depending on whether raw materials are purchased on a delivered, prepaid, or collect basis.
- Percent of truckload capacity utilized: Calculated by dividing the total pounds or volume shipped by the theoretical maximum. Unused capacity is an opportunity for more efficiency.
- Truck turnaround time: This is calculated by measuring the average time elapsed between a truck's arrival at the facility and its departure. This is an indicator of the efficiency of the lot and dock door space, receiving processes, and shipping processes. This also directly affects freight carrier profits on the business.
- On-time pickups: Calculated by dividing the number of pick-ups made on time (by the freight carrier) by the total number of shipments in a period. This is an indication of freight carrier performance, and carriers' effect on the shipping operations and customer

service.<sup>3</sup>

- Percentage of backhauls: This is calculated by dividing the number of backhaul trips to the total number of trips.

### Section 1.4.2 Transportation Management Systems

Transportation Management Systems (TMS) are used to manage freight planning and execution. TMS suites have been extended to include all transportation management functions from strategic planning and strategic sourcing of freight through visibility of freight, payment services and audit capabilities.<sup>4</sup>

The table below represents an evaluation of TMS vendors considering the factors, vendor commitment, vendor viability, operational planning functionality, transportation execution and visibility.

**Table 1: TMS Vendors**

Vendor	Strong Negative	Caution	Promising	Positive	Strong Positive
Elogex		√			
Global Logistics Technologies			√		
i2 Technologies				√	
LeanLogistics		√			
Logility			√		
Manhattan Associates			√		
Manugistics				√	
Nistevo		√			
Oracle		√			
RedPrairie			√		
SAP		√			
Schneider Logistics		√			

Source: Gartner Research 2003

<sup>3</sup> www.supplychainmetric.com

<sup>4</sup> 2003 Gartner Research; Market scope: US TMS Vendors.

### **Section 1.4.3 Operating Costs In Food Industry Transportation Operations**

In the food industry, the profit margins are approximately one percent after taxes for both food distributors and self-distributing retail chains. So, it is extremely important to manage costs in transportation, because savings go directly to the total profits of the corporation.

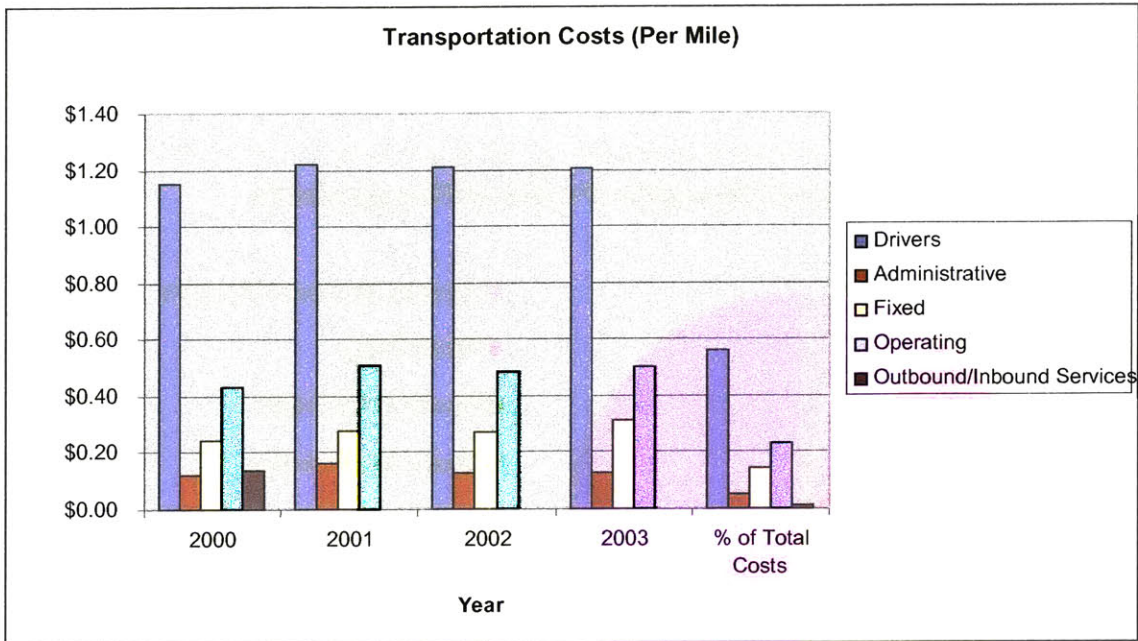
By managing fleet assets more effectively than competitors, grocery companies can seize the opportunity to obtain more business and make more money. In the long term, the most efficient transportation fleet that offers superior customer service will dominate its operating territory.<sup>5</sup>

The expenses in transportation operations can be categorized into five groups:

- **Driver Costs – Direct Labor:** Wages, benefits, welfare, insurance, travel.
- **Administrative Costs - Indirect Labor:** Supervision, clerical, benefits, supplies.
- **Fixed Costs:** Licenses, insurance, depreciation, taxes, loading supplies.
- **Operating Costs:** Maintenance, tires, fuel.
- **Outbound/Inbound Costs:** Services.

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<sup>5</sup> Kochersperger, Richard H, 2003 Food Industry Transportation and Fleet Maintenance Report, Food Marketing Institute, Washington, DC, 2003.



**Figure 1: Transportation Cost Breakdown**

Source: FMI Transportation Benchmarking Report

#### **Section 1.4.4. Trends and Benchmarks in Food Industry Distribution in the US**

Several trends in food industry transportation are observed in the 2003 Food Industry Transportation and Fleet Maintenance Report; some of the observations and the data which support them are present in this section.

##### **Outsourcing**

More companies continue the move to outsourcing the transportation function, seeking lower operating costs to serve their retail customers while reducing capital investment for rolling stock.

The entire food industry is critically analyzing the transportation function, seeking to find the proper balance between private-fleet ownership and outsourcing the delivery function. Wall Street exerts tremendous pressure to invest capital into resources that yield increased sales and

profits. As a result, many firms are minimizing the amount of funds directed to transportation equipment. Many distributors also seek to reduce labor costs by outsourcing the driving function.

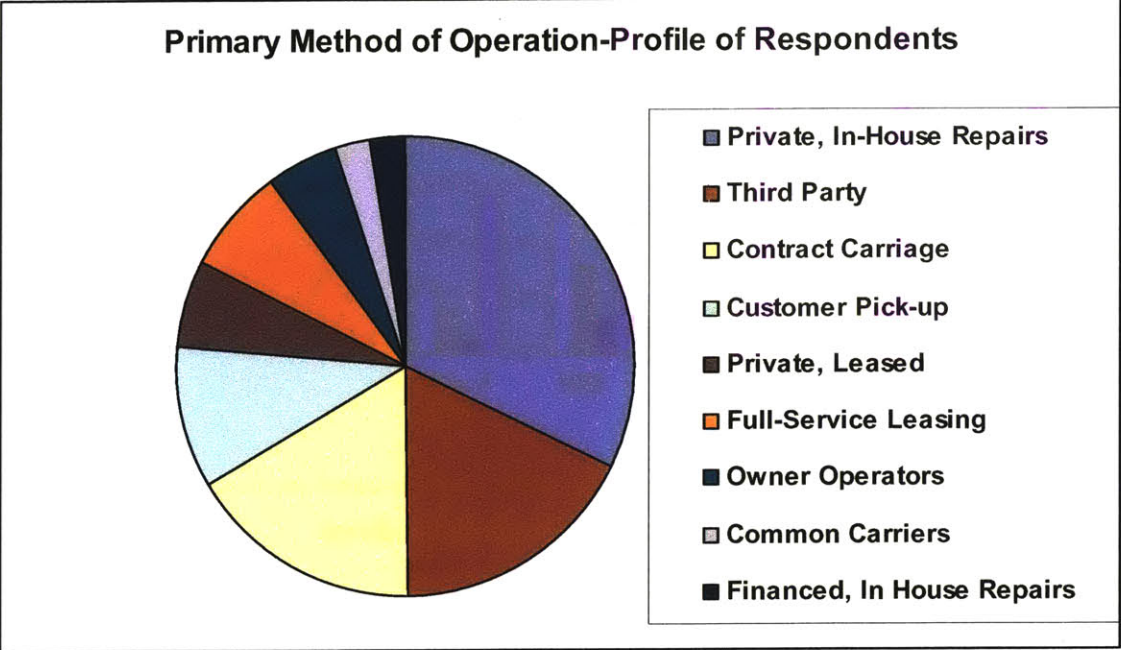


Figure 2: Food Industry Trend Report Survey Respondents

**Improvements in Key Expense Performance Indicators**

Due to the participation of several large food distributors that serve big retail chains and the consolidation of fleets into larger operations, there has been improvements in key performance indicators in the food retail industry.

**Table 2: Key Performance Indicator Trends**

<b>Key Performance Indicator</b>	<b>Trend</b>	<b>Reason</b>
Cost per Mile	Down	Increase in larger fleets, higher volume operations
Cost per Route	Down	More deliveries to high-volume stores closer to DC
Cost per Case	Down	Larger volume accounts, more cases delivered per stop
Stops per Route	Down	
Cases per Stop	Up	
Cases per Route	Up	
Weight per Route	Up	Bigger trailer, smaller cube cases
Sales per Case	Up	Increase in value-added products, refrigerated & frozen
Cost per Stop	Down	Larger order size, to larger volume stores
Miles per Route	Same	More deliveries to stores closer to DC
Weight per Case	Up	Smaller cases for ergonomic improvements

Source: FMI Transportation Benchmarking Report

### **Industry Consolidation**

The number of food distributors/retailers continues to shrink as the food industry seeks to achieve economies of scale through consolidation. Several large food retailers in the past year have closed numerous divisions and stores throughout their systems, seeking to eliminate unprofitable stores.

These consolidations reduce the number of fleets in the industry, as the larger companies absorb the new business into their existing supply chain infrastructure.

### **Wal-Mart Expansion**

The rapid growth of Wal-Mart continues to be the biggest influence in the industry. In the short period of 12 years, Wal-Mart has become the largest food retailer in the US and is currently growing sales in food categories at a rate of \$8 billion every year. To support its retail environment, Wal-Mart uses its own logistics system.

### **E-commerce**

Many technological developments connected to the internet could have a significant impact on transportation and traffic functions of the food business as auctions, instantaneous

bidding on purchases, extranets, and electronic information exchange, RFID, etc., revolutionize the way business conducted.

### **Changing Consumer Preferences**

Customers frequently change their shopping preferences and as a result, retail food distributors struggle to service new channels of distribution, such as Internet home delivery, drug stores and discount stores. The net result of all of this new competition is a reduction in sales for the traditional supermarket segment, which also has a negative impact on many food distributors and self-distributing chains.

All of these challenges affect the transportation function since these new customers and new relationships change previously established delivery patterns. The higher volume stores will seek more full-loads and more frequent drop shipments, while the smaller venues will require smaller shipments with more labor-intensive stocking procedures.

As a result, food distributors are experiencing tremendous volatility in their business. Changing business environments force retailers to continuously review their supply chain strategies to seek efficiency improvements and cost savings. Before examining opportunities for the retail partner in this project, the company's current practices will be described in Chapter 2: Current Operations.

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This thesis project was completed in a partnership between two MIT Masters of Engineering candidates and a retail grocery store. The name of the grocer will be omitted from associated thesis documents and selected numerical and financial figures will be disguised. Throughout the thesis documents, the retail grocer who partnered with MIT for this project will be referred to as ABC grocer. The grocer’s private will be referred to as RGPF (Retail Grocer’s Private Fleet), and the grocer’s wholesale supplier will be referred to as wholesaler YZ.

## Chapter 2: Current Operations

The purpose of the following document is to describe our current understanding of ABC operations, ordering processes, and transportation systems.

### *Section 1: ABC*

ABC is a grocery retailer with approximately 200 stores throughout several U.S. states. To present a brief snapshot of the scope of ABC sales and transportation network, Table 3: Outbound Transportation-related Expenses (in percentages of total sales) provides some key financial figures. Specific details of the network and carriers will be explained later in this document.

**Table 3: Outbound Transportation-related Expenses (in percentages of total sales)**

As Percentage of Sales:	FY03	FY04*	FY05*
RGPF (ABC) Expenses	0.72%	0.71%	0.65%
YZ Freight	0.23%	0.23%	0.24%
Total ABC Freight Expenses	.96%	.93%	.90%

\*projected

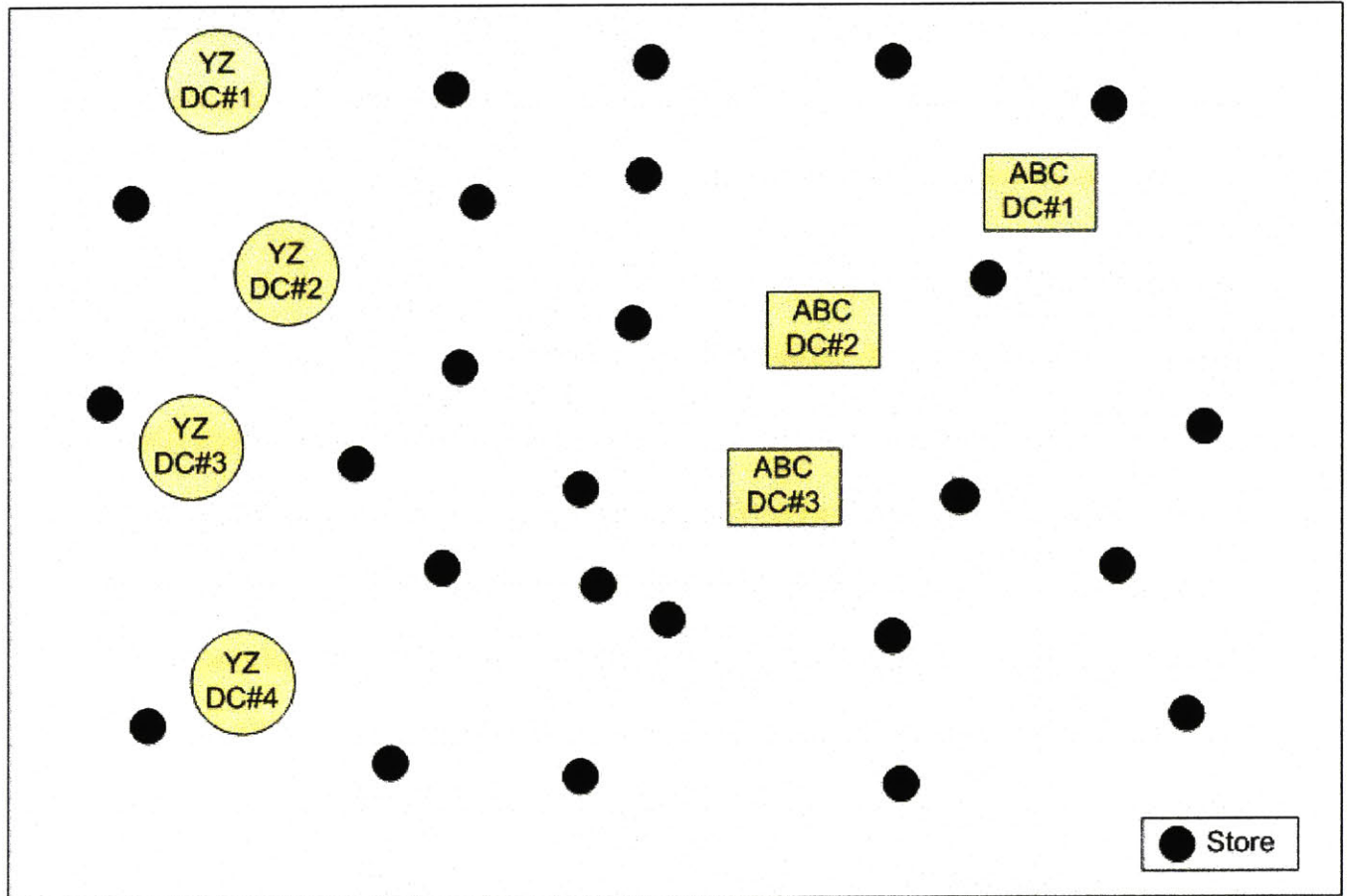
ABC overall goal is to provide quality groceries to retail stores so that they are available to customers when the customers need them and at a reasonable price. While providing this

service, ABC seeks to minimize operating and administrative costs while maximizing revenue. ABC supply chain network is an essential tool which supports the provision of goods to customers, as described in the next section.

## ***Section 2: ABC Supply Chain***

### **Section 2.1: ABC Stores & Distribution Centers**

To supply its retail stores, ABC owns and operates two distribution centers (DCs) and one cross-dock location. Additionally, four distribution centers owned and operated by YZ Wholesale Grocers directly service ABC retail stores, as described below (and illustrated in Figure 2: Distribution Centers). The two distribution centers will be referred to as ABC DC#1 and ABC DC#2; the cross-dock will be referred to as ABC DC#3. ABC DC#2 stocks produce, meat, fish, floral, and deli (i.e.: non-dairy perishables) products for all ABC stores. ABC DC#1 stocks fast-moving grocery (FMG) items (for 118 stores) and frozen food items (for 84 stores). ABC DC #3 serves as a cross-dock location to redistribute products arriving from 12-13 vendors on to ABC trucks for store delivery that same day. No products are stored in ABC DC#3 for any length of time, and items stored at YZ or ABC DCs are not involved in the traffic through this cross-dock.



**Figure 3: Distribution Centers**

## **Section 2.2: YZ Distribution Centers**

ABC stores which are not serviced directly by an ABC DC or cross-dock for a particular item receive deliveries from YZ Wholesale Grocers. YZ Wholesale Grocers purchases grocery items directly from vendors and then sells them to grocery store chains, including ABC and many of its competitors. YZ provides several different classes of products to a number of different portions of ABC stores. The YZ distribution centers which serve ABC stores will be referred to as YZ DC#1, YZ DC#2, YZ DC#3 and YZ DC#4. YZ DC#4 provides FMG items to 49 ABC stores and SMG items to all ABC stores. YZ DC#3 provides frozen food products to 117 ABC stores. YZ DC#2 supplies dairy products for all ABC stores. YZ DC#1 supplies FMG items to 34 ABC stores.

**Section 2.3: Network Clarifications:**

- Slow moving grocery items are supplied to all ABC stores from YZ DC#4. Those ABC stores which receive FMG products from YZ DC#4 receive their SMG with their FMG deliveries. For ABC stores which receive FMG from YZ DC#1, YZ trucks transport the SMG items for those stores from YZ DC#4 to YZ DC#1 for cross-docking before FMG deliveries are made out of YZ DC#1. Likewise, for ABC stores which receive FMG from ABC DC#1, YZ trucks transport the SMG items for those stores from YZ DC#4 to ABC DC#1 for cross-docking before FMG deliveries are made out of ABC DC#1.
- For some stores, dairy from YZ is picked up at YZ DC#2 and taken to ABC DC#2, to be incorporated with the perishable loads for those stores.
- Currently, besides above bulleted point, all YZ groceries are delivered to ABC via YZ trucks. In the past RGPF (ABC privately owned fleet) has occasionally picked up some of the loads and this option is being considered for re-implementation

**Table 4: Distribution Center Management and Functionality**

Distribution Center	Managed By		Function	
	ABC	YZ	Storage	Cross-dock
ABC DC #2	✓		✓	✓
ABC DC #3 (Cross-Dock Facility)	✓		(limited, currently unutilized, storage capacity)	✓
ABC DC#1	✓		✓	✓
YZ DC#1		✓	✓	✓
YZ DC#2		✓	✓	
YZ DC#3		✓	✓	
YZ DC#4		✓	✓	

## Section 2.4: Transportation

ABC is currently working with two contracted carriers and a number of third party carriers. In the table below, an ‘Inbound’ trip represents the hauling of products from vendor locations to ABC DCs while an ‘Outbound’ trip brings mixed pallets of products from a DC direct to retail stores for immediate sale.

**Table 5: Carriers**

	<b>Inbound</b>	<b>Outbound</b>
RGPF	✓	✓
YZ		✓
Third party carriers	✓	x

### Section 2.4.1: Outbound Transportation

Outbound carrier movements involve the transportation of groceries from DCs (YZ or ABC) and cross-dock locations to individual retail stores. The primary carriers for store delivery are YZ and RGPF; occasionally RGPF contracts the work out to a third party to pick groceries up at an ABC DC and deliver them to stores.

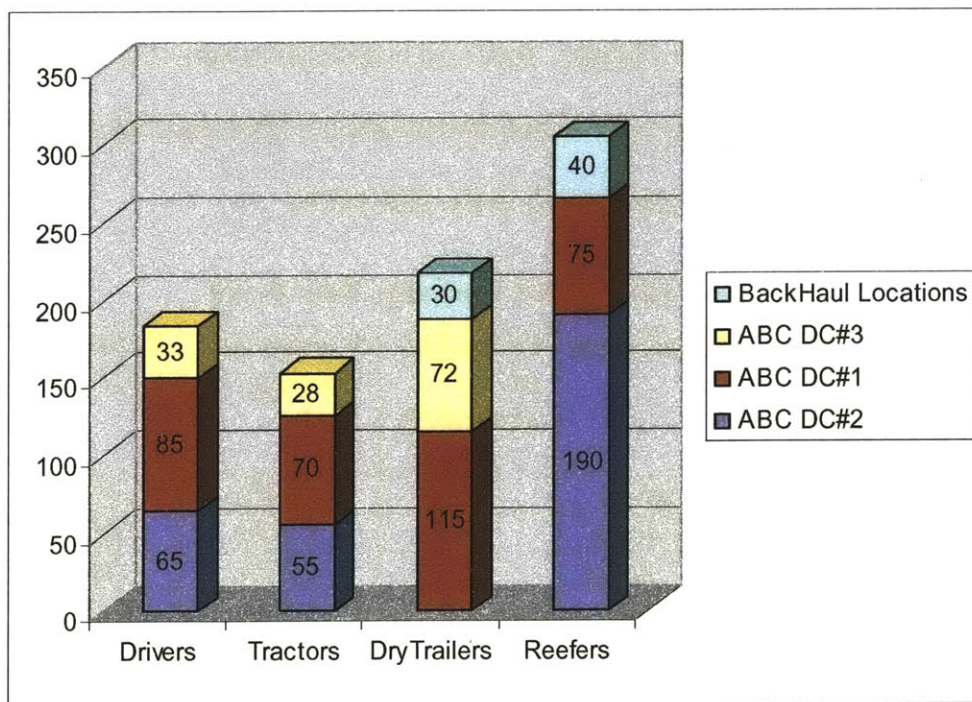
#### *Section 2.4.1.1: RGPF*

One of the two contracted carriers is ABC’s private fleet, RGPF (Retail Grocer’s Private Fleet). RGPF is a subsidiary of ABC headquartered near ABC DC#1. RGPF is responsible for outbound transportation from ABC DCs to ABC stores, from certain cross-dock points to ABC DCs, and from ABC DC#3 cross-dock to ABC stores. ABC pays \$1.90/mile to RGPF for all transportation services rendered; the miles driven by RGPF are broken down into two categories: store delivery miles and backhaul miles. The cost is actually calculated by determining total RGPF expenditures per period and then dividing by the total miles driven. The figure is always close to \$1.90, sometimes varying slightly from \$1.85 per mile to \$1.95 per mile. The costs are

calculated, re-examined and updated every quarter. RGPF serves for both inbound and outbound transportation.

RGPF uses software called Mobius TTS for tracking the mileages. Because the routing software that ABC is using, Manugistics, does not have reliable mileage information, ABC pays RGPF according to the mileage information that Mobius TTS provides. \$1.90 is applied to the total distance that RGPF trucks make including line hauls.

RGPF has 3 terminals which are located in ABC DC#1, ABC DC#2, ABC DC#3. The graph below shows the number of assets that are allocated to each of the terminals.



**Figure 4: RGPF Assets by Location**

*Section 2.4.1.2: YZ*

The other carrier that serves ABC is YZ Wholesale Grocers. YZ is one of the suppliers of ABC and responsible for outbound transportation from YZ DCs to ABC stores and certain cross-

dock points. (See above description of slow-moving grocery cross-dock.) For outbound transportation, depending on the type of grocery, the area is divided into regions, and each region is assigned to either YZ or RGPF transportation services.

YZ charges ABC based on two price components:

- upcharge rate (based on total value of goods shipped)
- delivery rate (based on total value of goods shipped)

The upcharge rate is the rate that YZ charges ABC for storing and selecting the goods in its DCs. If RGPF delivers YZ stored good, YZ still charges ABC for the upcharge rate. The upcharge rate is multiplied by the value of goods stored and shipped to determine the total warehousing and transportation charges. Rates are negotiated as part of the contract between YZ and ABC; current contract rates were established in October 2003 and will expire in October 2008. The upcharge rates are summarized in the table below.

**Table 6: YZ Upcharge Rate Detail**

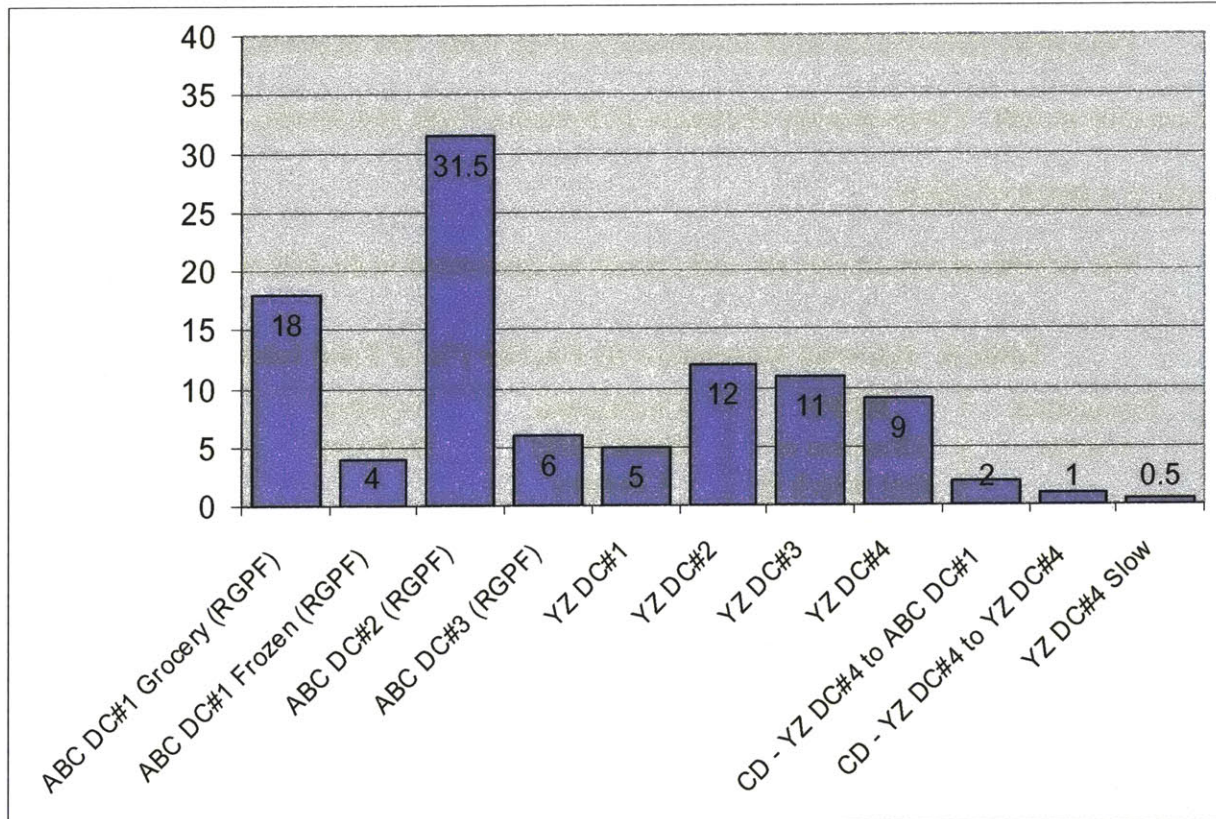
YZ Distribution Center	Type of grocery item	Destination	Cross-dock (if applicable)	Warehousing Upcharge	Delivery Upcharge	Warehouse picking fee
YZ DC#1	FMG	34 stores		1.94%	1.63%	
YZ DC#2	Dairy	All stores		1.20%	1.68%	
YZ DC#3	Frozen	117 stores		1.19%	1.58%	
YZ DC#4	FMG	49 stores		1.99%	0.97%	
	SMG	49 stores		1.97%	1.01%	
	SMG	118 stores	ABC DC#1	1.99%	1.13%	\$0.032/case
	SMG	34 stores	YZ DC#1	2.03%	1.38%	\$0.052/case

The breakdown of movement volume by carrier is depicted in the following table. The figures in Table 7 were calculated based on historical data for weekly load volume outbound from each DC.

**Table 7: Outbound Movements by Carrier (% of Total Outbound)**

Origin/ Carrier	RGPF (fraction of that which is outsourced)*	YZ
ABC DC#1 Grocery	18	--
ABC DC#1 Frozen	4	--
ABC DC#2	31.5	--
ABC DC#3	6	--
YZ DC#1	--	5
YZ DC#2	--	12
YZ DC#3	--	11
YZ DC#4	--	9
YZ Cross-dock – DC#4 to ABC DC#1	--	2
YZ Cross-dock – DC#4 to YZ DC#1	--	1
YZ DC#4 Slow	--	.5

Note: Overall, within RGPF miles, approximately 10% are outsourced.



**Figure 5: Outbound Carrier Movements (% of Total Outbound)**

## Section 2.4.2: Inbound Transportation

ABC currently works with 37 third party carriers for inbound transportation. This number can vary year to year. These carriers are mostly preferred for the deliveries from the vendors which are located outside of the states where ABC stores are located, but occasionally third party carriers are used within the region as well. Third party carriers are utilized within the region if the RGPF fleet does not have the appropriate equipment to transport the product (i.e. a paper supplier requiring 53 foot, high-cube trailers) or if RGPF cannot transport the goods as cheaply as a third party carrier could. There are a total 481 (city-to-city) lanes defined as inbound routes within ABC supplier network. Annually, ABC gives expected volumes per lanes to the carriers, and the carriers declare their prices based on this given information. Then, ABC decides whether to work with any particular carrier for the given lane.

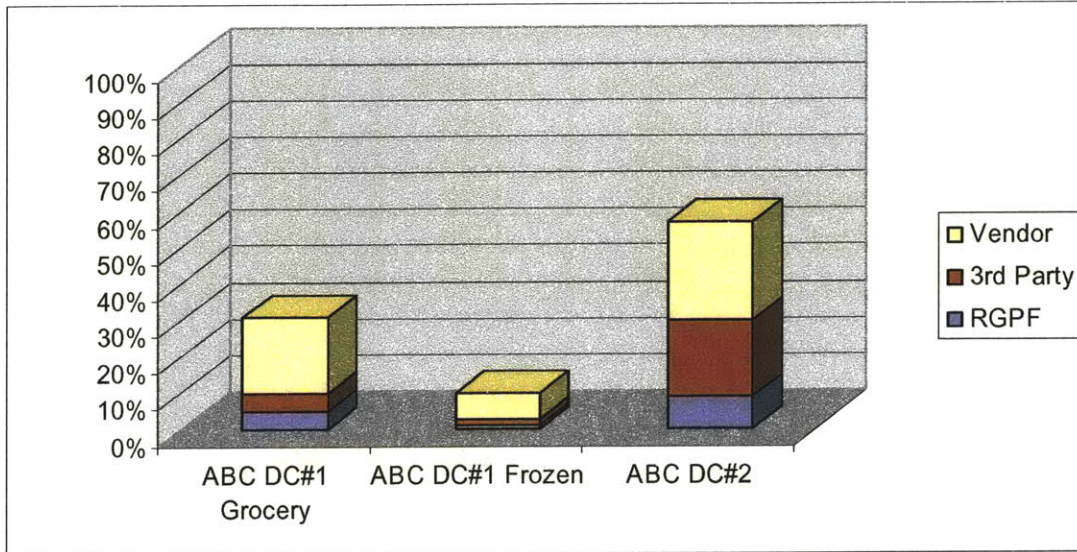
The carrier selection for truck movement is made daily. The dispatcher looks at the price information at ABC Transportation Management System (TMS) and decides which carrier to assign to a group of orders.

The volume of movements for each carrier is represented in the following two tables.

**Table 8: Inbound Movements by Carrier (% of Total Inbound)**

Destination/ Carrier	RGPF (fraction of that which is outsourced)*	Contracted Third Party Carriers	Vendor Delivery	Percent of total inbound volume
ABC DC#1 Grocery	5% (10%)*	5%	21%	31%
ABC DC#1 Frozen	1% (10%)*	2%	7%	10%
ABC DC#2	9% (10%)*	21%	27%	57%
Total	15%	28%	55%	98%

Note: Overall, within RGPF miles, approximately 10% are outsourced; values add to 98% due to rounding errors



**Figure 6: Inbound Carrier Movements (% of Total Inbound)**

**Table 9: Approximate Average Weekly Total Carrier Movements**

Weekly Total Movements (Low/High)	Jan – Apr	May - July	Aug - Oct	Nov - Dec
Inbound	1150			
<i>Outbound RGPF</i>				
ABC DC#3	119/164	101/150	123/154	128/167
ABC DC#1 Grocery	375/445	395/476	418/505	261/500
ABC DC#1 Frozen	75/102	88/111	85/98	79/127
ABC DC#2	602/862	735/1054	661/800	564/912
Outbound YZ	860			

### Section 2.5: Carrier Utilization

The current utilization of RGPF trailers for outbound movements (deliveries to stores) is outlined in the table below. (The term ‘cube’ refers to volume of product shipped, measured in cubic feet.)

**Table 10: RGPF Outbound Cube Utilization**

	<b>Maximum Cube</b>	<b>Expected Cube</b>	<b>Actual Cube</b>	<b>Cube Utilization</b>
<b>ABC DC#2</b>	1540	1350	1143	74.2%
<b>ABC DC#1 Grocery</b>	1800	1750	1447	80.4%
<b>ABC DC#1 Frozen</b>	1540	1350	1105	71.8%
<b>ABC DC#3</b>	1800	1550	938	53.2%

**Table 11: RGPF Inbound Cube Utilization**

	<b>Cube Utilization</b>
<b>ABC DC#2</b>	61%
<b>ABC DC#1 Grocery</b>	50%
<b>ABC DC#1 Frozen</b>	75%
<b>ABC DC#3</b>	95%

### ***Section 3: Operational Processes & Information Systems***

#### **Section 3.1: Ordering – Non-Perishables**

To replenish stock of non-perishable items to the stores, ABC uses an in-house IT system called Supervised Re-Order (SRO). Orders are created via automated processes for most stores and by hand for some stores. Orders for non-perishable items are run on a daily basis. Quantities are based on previously established forecasts, knowledge of sales and promotion, and current inventory levels.

#### **Section 3.2: Ordering – Perishables**

For the ordering of perishable items ABC is using an internally developed system called Perishable-Re-Order (PRO). The ordering process covers a 3 week cycle. In the 1<sup>st</sup> week, buyers finalize product recommendations for the third week, and stores review these recommendations. In the 2<sup>nd</sup> week, stores begin keying in store amendments, and then they are transferred to the PRO system. Buyers can view amendments in the PRO system. In the third week the deliveries

to the stores are made, and stores have a chance to make adjustment 2 days in advance of the delivery.

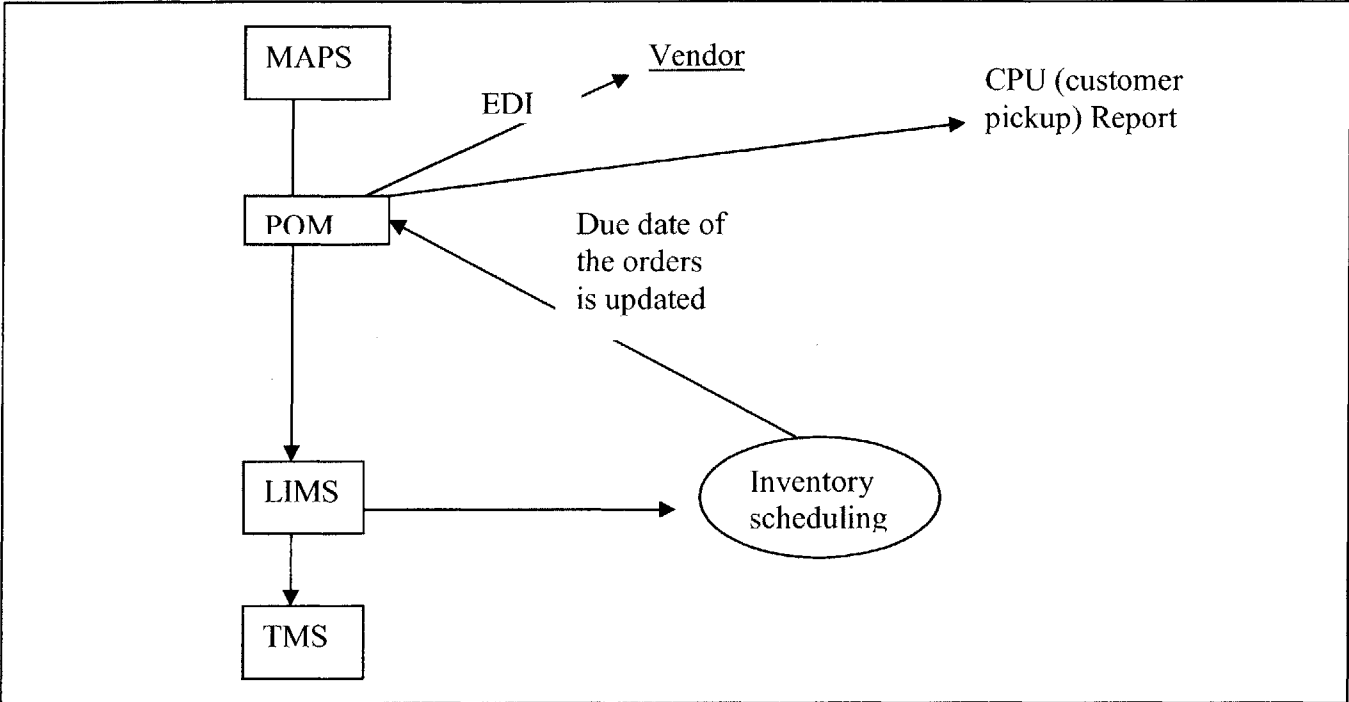
### **Section 3.3: Ordering Process - Inbound**

ABC purchases grocery items directly from vendors to supply its two DCs and one cross-dock facility; these vendors are located all over the United States. Every Monday, orders are downloaded from POM to LIMS, new orders are created, and carriers are assigned to the transportation of each order from supplier location to ABC DC. The orders are coordinated so that deliveries arrive over the course of a week, in volumes that can be handled by the staff on hand at the DC on the day and time of arrival.

In the procurement of each product, there are different costs associated with each of the possible transportation options. ABC reviews the costs of each option annually and updates the information in TMS so that transportation decisions can be made based on current data. The three possible transportation options associated with delivery of groceries to distribution centers are outlined below:

- Delivery: The vendor delivers the product to one of ABC distribution centers and ABC is charged the cost of delivery
- Pickup via RGPF: A RGPF truck travels to the vendor pick-up point for the ordered item, retrieves the product, and delivers it to the appropriate ABC facility.
- Pickup via Third party carrier: ABC hires third party transportation provider to pick up the product at the vendor's pick-up point and then deliver it to the appropriate ABC facility.

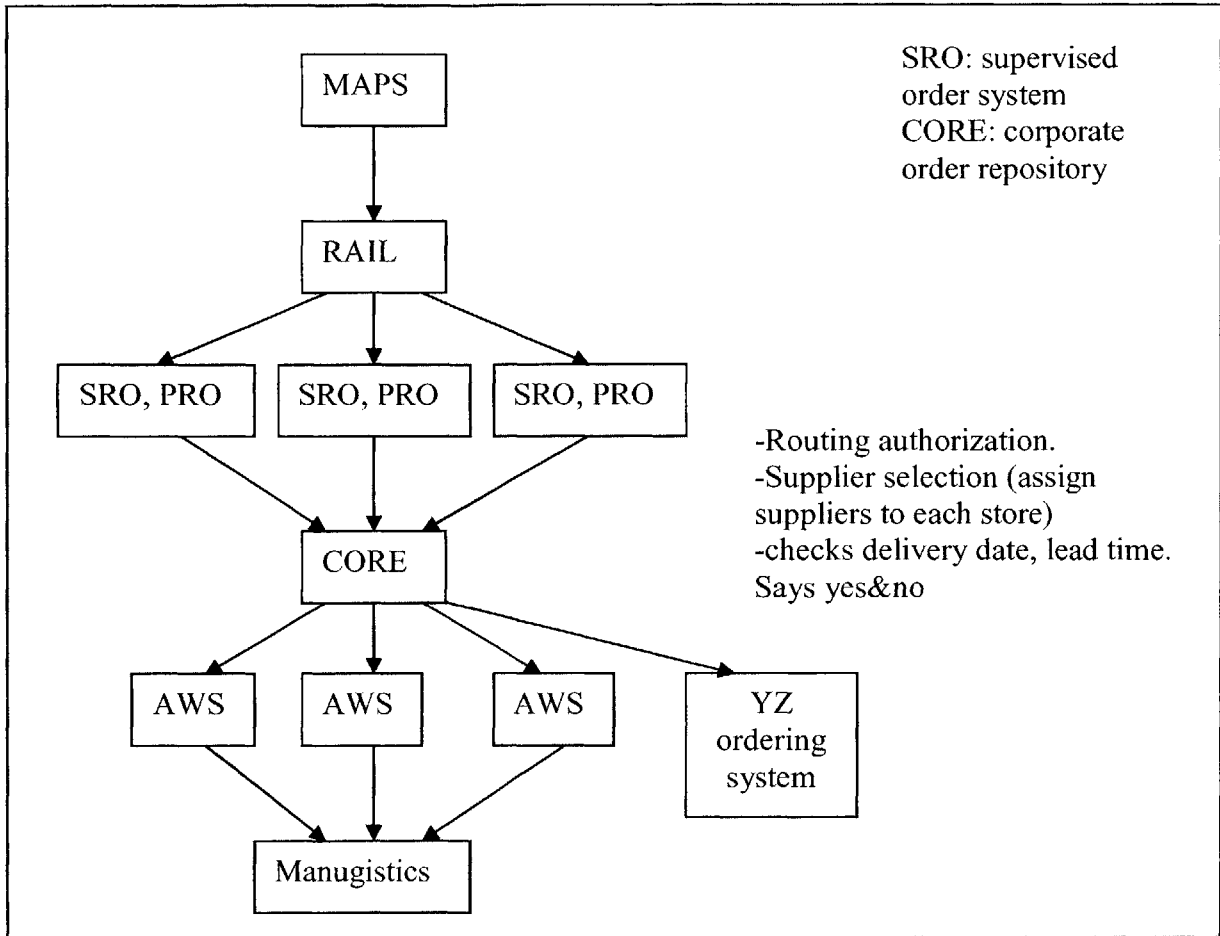
ABC utilizes several IT systems to store the data relevant to these decisions and to facilitate the ordering and carrier choice processes. Below is a representation of those systems.



**Figure 7: Inbound Order Process Information Flow**

**Section 3.4: Ordering Process - Outbound**

The information flow between the systems is illustrated below.



**Figure 8: Outbound Order Process Information Flow**

The following figures depicts the flow of information and decision making processes throughout the transportation function, from order placement to product delivery.

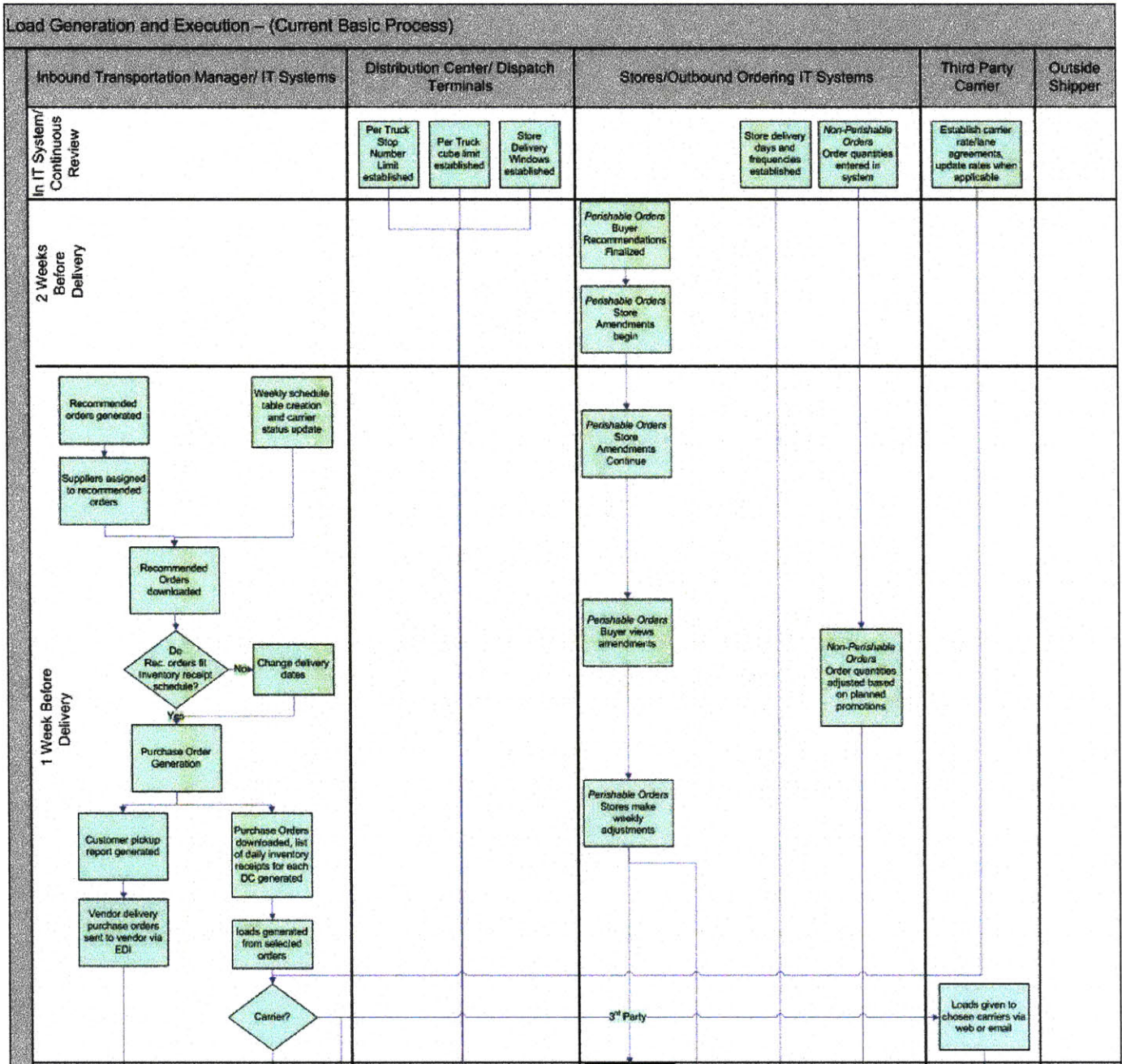
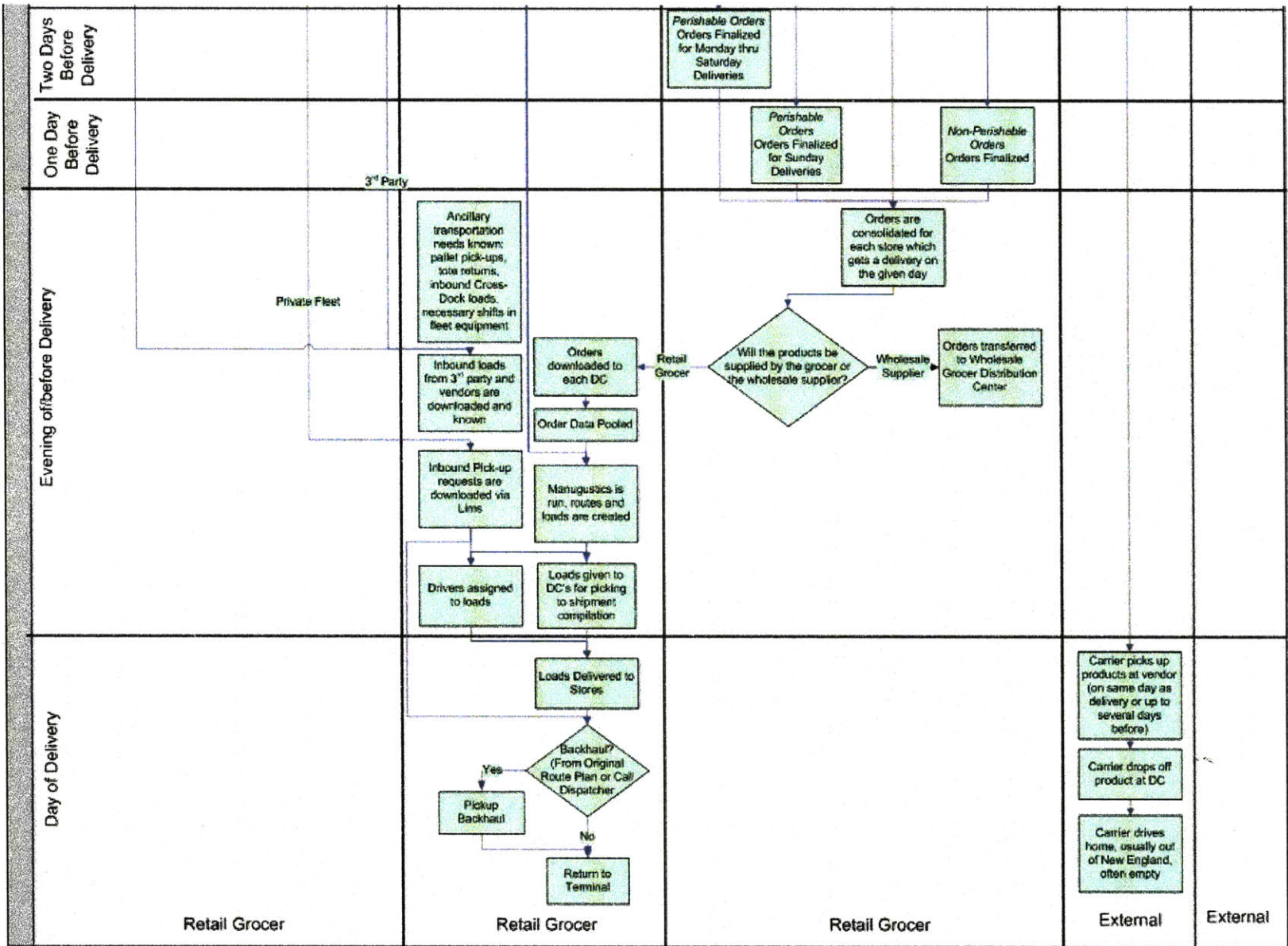


Figure 9: Information Flows Through the Transportation System (Top Half)

Figure 10: Information Flows Through the Transportation System (Bottom Half)



The next three chapters will describe the current transportation strategies and recommend processes to generate coordinated loads within the grocery retailer's network.

In particular, there are several areas of focus within the retailer's transportation operations. As described in Chapter 2: Current Operations, ABC has 2 distribution centers and a cross dock facility, each with a truck terminal on-site. Grocery deliveries to stores may be made from the wholesaler's DC via wholesaler's trucks, or from retailer's DCs via its private fleet or, occasionally, via third party carriers contracted by the fleet. For inbound deliveries (groceries from suppliers to the retailer's DCs) there are three possible means of transportation. The groceries may be delivered by the vendor, picked up by the retailer grocer's private fleet, or picked up by a third party carrier, contracted to the retailer.

For this particular retailer, several areas were identified as potential stepping stones in its plan to begin a central dispatching operation. These areas of opportunity include:

- Using third party carriers for store deliveries
- Planning routes to increase the level of coordination between inbound and outbound transportation
- Using the retailer's private fleet to provide carrier service for other shippers

The structure and decision making process for transportation operations is graphically depicted in Figure 9: Information Flows Through the Transportation System (Top Half) and Figure 10: Information Flows Through the Transportation System (Bottom Half). All of the proposed possible changes in transportation system dynamics are suggested in relation to the retailer's private fleet and its operations, assuming the wholesale supplier will continue to operate and deliver products as it has in the past, unless otherwise specified. These ideas are discussed and explored in the next three chapters.

## **Chapter 3: Third Party Carriers for Outbound Deliveries**

### ***Section 1: Background***

The grocery business involves the sale of many low-margin commodity items; for the partner company in this project, total freight expenses total millions of dollars each year. For this company and its 200 plus stores, annual transportation costs are approximately one percent of annual sales; any significant cost-savings opportunity could receive serious attention. Transportation costs depend on the rates at which carriers agree to transport freight within the supply chain of an organization. The retail grocer who is the partner for this thesis project has recognized that a significant cost savings opportunity might be realized if carriers who are currently contracted to deliver goods from vendors to the retailer's DCs were given outbound loads to carry in addition to existing inbound business. Upon inquiry, the carriers suggested that they would charge a rate slightly higher than fleet variable cost to deliver loads from DCs to stores. In addition, if the carriers were given regular business, they project a 10% reduction in both inbound and outbound transportation rates.

### ***Section 2: Constraints***

Many factors must be included in the process to decide if third party carriers should be utilized to deliver loads from DCs to stores. These considerations include quality, cost, and routing/scheduling concerns.

First, the quality of service provided by the carrier must be acceptable; an advantage of a private fleet is total ownership and control, but this is relinquished when outside carriers are used. In this scenario, the carriers in question are already frequently utilized to bring inbound

products to DCs. Since the carriers are already trusted for inbound transportation, it should not be extremely difficult to establish satisfactory terms of outbound transportation carriage.

Second, routing and scheduling details must be examined to ensure the feasibility of the plan. The carriers must be available to pick up outbound loads when the loads are ready at the DC, and at a time such that the estimated arrival at the store will be within the store's delivery window. Additionally, each store only receives deliveries on certain days of the week, so if the carrier makes store deliveries on its return trip home, the two must be coordinated. Equipment compatibility is important but should not be a complication because the same type of trailer required to bring the products in to the DCs is needed to carry the same products (now picked for specific stores) for delivery.

Ancillary transportation issues must be incorporated in the planning process; some details to include are the hauling of pallets and dunnage and the handling of dropped trailers. If third party carriers are often used to bring outbound loads to certain stores, these stores will accumulate pallets and any other items which need to return to the DCs. Additionally, the third party carriers will prefer hauling a trailer they can drop at the store; dropped trailers must be managed so that the flow of equipment within ABC's network does not become uneven and trailers do not accumulate at stores.

Clearly cost must also be considered. Some cost disadvantages might result from increased costs to coordinate the supplemental use of third party carriers, as well as the direct cost of additional outside transportation fees. Performance issues regarding on-time delivery and quality could arise and result in cost increases. Variable cost savings will result from discounted inbound and outbound transportation rates. Total fixed costs could eventually decrease if third party carrier utilization ultimately reduces RGPF's equipment requirements, thus reducing the

fixed asset base. If the carriers are appreciative of the return trip business, the retailer-carrier relationships could improve and further cost discounts and collaboration might be possible in the future.

Guidelines for approaching this problem to choose store deliveries for transport by third party carriers and calculate associated costs and benefits are outlined in the following section.

### ***Section 3: Planning***

In considering DC-to-store loads for carriage by third parties, each DC should be examined individually. If third party carriers are used for outbound transportation, it is assumed that the carriers will be prefer trips with as few stops as possible and which are close to their planned route home, or close to an alternative homebound route of similar length. To illustrate some factors which might influence load generation and carrier choice at a specific DC, consider the following example.

Currently, the retail grocer delivers non-dairy perishable items to all ~200 stores in its network from one DC. There is more variability in the demand seen at this DC than at all of the others, and the vendors which supply this DC vary throughout the year with regional growing seasons. In addition, many of the carriers from outside of the region which deliver to this DC already have other sources of return-trip business in the region. There are many issues involved in looking at transportation to and from each DC, these variations between DCs are outlined below in Table 12: DC Characterization.

**Table 12: DC Characterization**

	<b>Seasonality of Demand</b>	<b>Remoteness of site (distance from other potential business)</b>	<b>Desirability of return trips to Third party carriers</b>	<b>Average Stops per Load</b>	<b>Average Weekly Loads</b>
<b>ABC DC#1 Grocery</b>	Moderate	High	High	1.5	382
<b>ABC DC#1 Frozen</b>	Moderate	High	High	3.7	85
<b>ABC DC#2</b>	High	Moderate	Low	1.5	674
<b>ABC DC#3</b>	Low	Moderate	None	3.9	137

Scale: none, low, moderate, high

Since the different DCs experience different demand volumes and characteristics, it seems that third party carriers for outbound loads should be examined and utilized to match the needs of the DC with the preferences of the carrier. The suitability of a specific carrier to deliver products to stores will also depend on the frequency with which the carrier makes deliveries to the DC, its desire for round trip business, and the planned destination of the carrier’s truck after departing the retail grocer’s DC.

Once a list has been made of potentially suitable carriers and their planned destinations, a list of eligible stores should be constructed. The list should be created for each DC/carrier combination (although carriers traversing similar routes out of the region would share similar store lists) and consist of stores which could receive loads via third parties from the DCs. The routes will be designed keeping in mind a preference to minimize miles traveled off the highway and number of stops made. Scheduling concerns will be incorporated, keeping in mind store delivery time windows as well as the days of the week which the store receives shipments from the given DC.

Once candidate routes are created, costs should be calculated to estimate the feasibility of individual routes and of the entire proposition. To calculate costs, first the private carrier's cost to deliver the groceries to stores should be calculated, based on the private fleet's variable cost per mile, currently estimated at \$1.30. Then, the cost paid to the third party carrier for miles traveled en route to the stores should be calculated at the quoted cost; currently, per discussions with carriers, that cost is estimated at \$1.90 per mile. Lastly, the resulting cost savings on both the inbound and outbound routes should be determined; this will be estimated at %10, also following discussions with current carriers.

Projected savings on inbound transportation costs will be estimated to be proportional to the volume of outbound traffic granted to the carrier. If the carrier currently delivers twice per week to the DC, and is now given outbound business once per week, it will be assumed that the inbound 10% cost savings are only accrued once per week.

One additional area of exploration and cost analysis could involve comparing the feasibility of using third party carriers to deliver from the DCs to stores which are currently served by the wholesale supplier. Using third party carriers to deliver goods currently supplied by the wholesaler is not entirely straightforward due to contract rates and DC capacity issues. Current transportation upcharges paid to the wholesale supplier are based on the network of stores supplied; if some of the stores are given to third party carriers (possibly because of their proximity to the highway), the wholesaler might want to increase its network-wide transportation upcharge fee. Additionally, the approximately 200 stores in the network are served by both the retail grocer's own DCs and the wholesaler's DCs because the retailer does not have the capacity to serve all its stores with all SKUs of all product lines. Therefore, while it might be favorable to

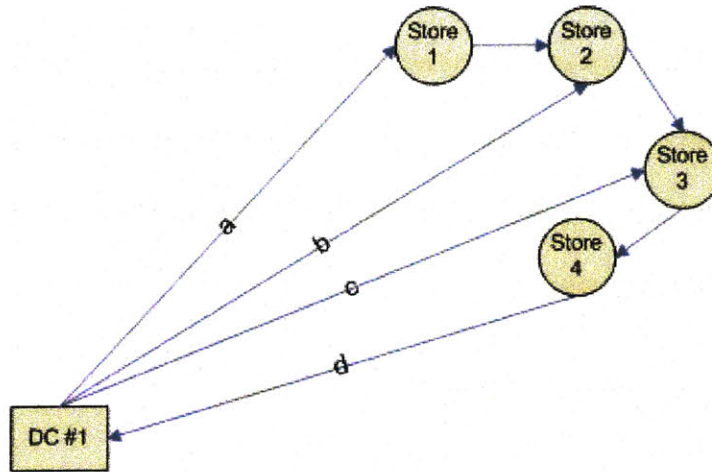
switch a few stores from the wholesaler to the retailer's DCs, it should be done after careful consideration.

#### ***Section 4: Analysis***

The above discussion outlines the many factors which should be considered in deciding if stores should be served by third party carriers after the carriers make deliveries to the retail grocer's DCs.

#### **Section 4.1: Estimating Costs: Private Fleet**

To compare the cost of delivering groceries to stores using a third party carrier instead of the private fleet, an accurate estimation of the cost incurred to deliver one load to one store from a specific DC needs to be approximated. To estimate the cost of serving one store, it is necessary to consider that the private fleet usually delivers to multiple stores on each trip. To approximate the cost of delivering to one store alone, it is necessary to calculate first the total cost of one route and then to divide by the number of stores served by that trip to find the approximate cost per store for transportation. This methodology is illustrated below in Figure 11: RGPF Route and in Figure 12: RGPF Route Miles Calculation Explanation.



**Figure 11: RGPF Route**

RGPF Route Mile Estimate Explanation

Let  $z$  = RGPF Variable Cost per mile (\$)

Let  $n$  = Average # of stops on route from DC

Let  $m$  = Estimated average distance between stores on a DC #1 route

Store #	DC #1	DC To Store Area Round Trip	Distance Traveled Between Stores	Total Distance Traveled	Distance Traveled Per Store	Mileage Used To Estimate RGPF Deliver Cost To That Store	Estimated RGPF Cost To Deliver To That Store From DC#1
1	a	2*a	$m^{*(n-1)}$	$(2*a)+m^{*(n-1)}$	$((2*a)+(m^{*(n-1)}))/n$	$((2*a)+(m^{*(n-1)}))/n$	$z^{*}(((2*a)+(m^{*(n-1)}))/n)$
2	b	2*b	$m^{*(n-1)}$	$(2*b)+m^{*(n-1)}$	$((2*b)+(m^{*(n-1)}))/n$	$((2*b)+(m^{*(n-1)}))/n$	$z^{*}(((2*b)+(m^{*(n-1)}))/n)$
3	c	2*c	$m^{*(n-1)}$	$(2*c)+m^{*(n-1)}$	$((2*c)+(m^{*(n-1)}))/n$	$((2*c)+(m^{*(n-1)}))/n$	$z^{*}(((2*c)+(m^{*(n-1)}))/n)$
4	d	2*d	$m^{*(n-1)}$	$(2*d)+m^{*(n-1)}$	$((2*d)+(m^{*(n-1)}))/n$	$((2*d)+(m^{*(n-1)}))/n$	$z^{*}(((2*d)+(m^{*(n-1)}))/n)$

**Figure 12: RGPF Route Miles Calculation Explanation**

Using these methodologies, the cost of delivering one load to one store from each DC was established.

## Section 4.2: Estimating Costs: Wholesale Supplier YZ

While this project was conducted with the understanding that the network of stores and the DCs which serve them would remain unchanged, the costs of using YZ DCs to supply the stores was also calculated. The cost to serve one store using YZ is straightforward because it is based entirely on the value of the load being delivered. Upcharge rates do vary based on the DC

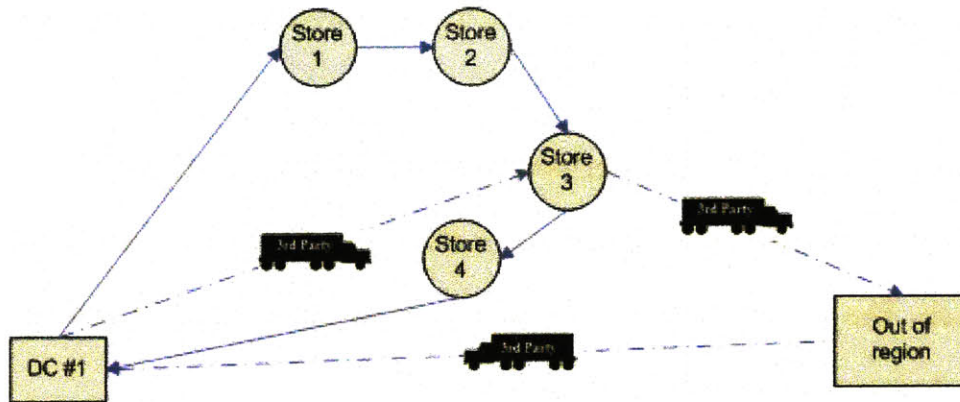
which is supplying the store, so if a store is currently served by ABC's DCs, the wholesale supplier transportation cost was calculated using the upcharge rate for the closest YZ DC which supplies the correct type of grocery items. The total cost of supplying groceries for that one store was then calculated and used to compare transportation costs with the costs of the private fleet and the costs of a third party carrier.

### **Section 4.3: Estimating Costs: Third Party Carriers**

The next step is to estimate how much it will cost to deliver the same load from the DC to the store using a third party carrier instead of the private fleet. As discussed earlier, the outside carriers will appreciate additional business but will be unwilling to travel very far from their route home, make multiples stops, or to wait long during loading and unloading. Keeping this in mind, this analysis was carried out assuming that the business given to third party carriers would be assigned so that each time a carrier was asked to do store deliveries, it would carry only one load for one store. (This is very different from private fleet operations where the fleet trucks try to maximize trailer utilization and usually stop at between 2 and 4 stores.)

Further, it is assumed that the more desirable business for the outbound carriers is to deliver to those stores close to a direct route home. If a store is some number of miles directly opposite the direction of the home terminal, this route will probably not be considered.

Figure 13: Third Party Carrier Outbound Route illustrates a typical outbound route traveled by the private fleet as well as the possible path of a third party carrier truck delivering outbound groceries; the third party truck makes only one stop and then departs the region.



**Figure 13: Third Party Carrier Outbound Route**

The total cost calculated for delivery of goods from the DC to a grocery store is estimated based on the rate quoted by the carrier and the discount rate promised by the carrier under the condition of round trip business. Unlike the private fleet, the carrier is not making a round trip, but simply dropping goods at a store on its way out of the region. As a result, when comparing the costs of using the two providers, the difference between a four store route and a 1 store drop off are illuminated.

In addition to the cost required to pay the carrier to deliver goods to stores, the carriers have promised that they will reward round-trip business by offering a discount on both the inbound and outbound transportation costs. As discussed earlier, it is assumed that the discount given on inbound freight will be proportional to the volume of the outbound business granted.

Several costs were calculated to determine total third party carrier outbound carriage prices. First the cost of delivery was calculated based on the dollars per mile rate, the minimum trip fee, and the round-trip business discount. A minimum trip fee has not previously been mentioned but it should be mentioned that while dollars per mile gives a good idea of the incremental cost to operate a fleet, for short trips it underestimates the true cost. Additionally, if a carrier is moving a load 2 miles, they will want to receive a minimum shipping fee, not just the \$1.90/mile rate for the 2 miles. This concept applies similarly to the private fleet; for this

analysis it will be assumed that the cost of delivering any one load to a store cannot be less than \$50, no matter how low the mileage.

In addition to the price paid to the third party carrier for delivering a load to the store, because the carrier now has round trip business, a discount will be given on the inbound half of the trip as well. The magnitude of this discount is based on the frequency of outbound business granted and the rate and length of the inbound route.

To determine the carriers which might be interested in this business opportunity and the magnitude of the opportunity, the assortment of carrier lanes and load frequencies was examined. Next, carriers with inbound business to each DC at least once per week were identified. The average length of the lane traveled inbound and price per mile paid to that carrier were calculated for the top carriers (those with business at the DC at least once per week). The total number of deliveries per week for each of these top carriers was summed to determine the average magnitude of opportunity for third party carrier store deliveries at each DC. For example, if 2 carriers each had inbound business 3 times per week into one DC, the total magnitude of the opportunity would be 6 loads per week.

Once the magnitude of the opportunity was determined for each DC, routes were identified as profitable for each DC and an appropriate number of stores and trips were selected to approximately match the available opportunity. Stores were chosen by first ranking them on greatest cost advantage for using the third party carrier and then only chosen if the carrier was starting from outside of the region and then needed to return-trip business. If a variety of stores were equally profitably served by the third party carrier, the stores closest to a potential route out of the region were chosen first.

After the cost of serving a store using each carrier was calculated, the costs were compared and the potential savings to be realized from using third party carriers were determined for each DC. The following tables will illustrate sample savings to be realized from implementing this project.

Table 13: Third Party Carrier Inbound Lanes to ABC’s DC lists hypothetical carrier lanes and rates which could apply to ABC DC#1. The carrier-lane combinations which are highlighted are contracted for one or more loads per week, so these would be part of the 99 loads which were selected as potential opportunities for matched inbound-outbound third party carriage. Table 14: Third Party Parameters lists the additional parameters which are obtained as a result of the analysis in Table 13: Third Party Carrier Inbound Lanes to ABC’s DC.

**Table 13: Third Party Carrier Inbound Lanes to ABC’s DC**

Carrier	Lane Starting Point	DC #1 Location	Miles	Cost/mile	Total cost	Frequency (trips/week)
1	SP1	DC1	80	\$1.80	\$144.00	3
2	SP2	DC1	150	\$2.50	\$375.00	.8
3	SP3	DC1	310	\$2.10	\$651.00	2
4	SP4	DC1	245	\$2.00	\$490.00	1.4
5	SP5	DC1	340	\$2.35	\$799.00	6

From this data and other data mentioned earlier, the following parameters were identified.

**Table 14: Third Party Parameters**

<b>System-wide PARAMETERS:</b>	
RGPF Variable Cost per mile (\$)	1.3
third party carrier (outbound) Cost per mile to deliver to stores (\$)	1.9
third party carrier estimated inbound discount rate (.1 = 10%)	0.1
third party carrier estimated outbound discount rate (.1 = 10%)	0.1
average value of a dry grocery delivery, YZ (\$)	\$9058
RGPF Minimum Charge per trip (\$)	50
third party carrier minimum cost per trip (\$)	50
third party carrier cost per stop (\$)	0
<b>ABC DC#1, Grocery: PARAMETERS:</b>	
Average distance between stores on a route (Network-wide)	23.2
Average number of stops per load (RGPF)	1.5
Average weekly loads	382
third party carrier percent of inbound	16%
third-party carried inbound loads per week	61.5
# of third party carriers delivering once per week or more	28
total weekly trips by those carriers	99
third party carrier average length of inbound lane (for top carriers)	427.5
third party carrier average inbound cost/mile (for top carriers)	1.86
Average number of stops per load (third party carrier)	1
Weekly Potential ABC DC#1 Loads	99.00

The next table, Table 15: Third Party Calculations, is a detailed display of the calculations performed to determine the feasibility of this project for the dry grocery operations out of ABC DC#1. The stores in the table are ordered by profitability of third party carriage. Toward the top of the list, some stores are feasible because they are near to carriers' potential routes home, on the way out of the region, these are unshaded in the table. As the list continues, the trips become less profitable and would not be considered by third party carriers, only the first 10 of these stores are included in the table; all unfeasible stores are shaded in the table.

Table 15: Third Party Calculations

Store Number	Deliveries per week		FMG Supplier	Up-charge	Distance to DCs (miles)			Grocery (1 load)						Projected Savings	
	YZ GROC	ABC DC#1 GROC			ABC DC#1	YZ DC#4	YZ DC#1	RGPF	YZ	3rd Party Carrier			Lowest Cost Provider	Min possible weekday deliveries	Weekly savings
			PRIM	YZ upcharge rate	ABC DC#1	YZ DC#4	YZ DC#1	Cost to serve with RGPF	Cost to serve w/ YZ	Cost to do outbound deliveries	Inbound Savings	Total financial impact			
1		7	ABC DC#1	1.633	10	183	137	50.00	279.22	50.00	79.52	(29.52)	3rd		
2		7	ABC DC#1	1.633	12	185	175	50.00	279.22	50.00	79.52	(29.52)	3rd		
3		7	ABC DC#1	1.633	18	161	150	50.00	279.22	50.00	79.52	(29.52)	3rd	5	397.58
4		6	ABC DC#1	1.633	18	186	176	50.00	279.22	50.00	79.52	(29.52)	3rd		
5		6	ABC DC#1	1.633	20	150	139	50.00	279.22	50.00	79.52	(29.52)	3rd	4	318.06
6		6	ABC DC#1	1.633	23	150	139	50.00	279.22	50.00	79.52	(29.52)	3rd	4	318.06
7		6	ABC DC#1	1.633	25	197	187	53.39	279.22	50.00	79.52	(29.52)	3rd		
8		5	ABC DC#1	1.633	28	155	144	58.59	279.22	50.00	79.52	(29.52)	3rd	3	264.31
9		7	ABC DC#1	1.633	28	148	137	58.59	279.22	50.00	79.52	(29.52)	3rd	5	440.51
10		5	ABC DC#1	1.633	29	197	187	60.32	279.22	50.00	79.52	(29.52)	3rd		
11		5	ABC DC#1	1.633	29	198	187	60.32	279.22	50.00	79.52	(29.52)	3rd		
12		6	ABC DC#1	1.633	30	201	190	62.05	279.22	51.30	79.52	(28.22)	3rd		
13		7	ABC DC#1	1.633	32	201	190	65.52	279.22	54.72	79.52	(24.80)	3rd		
14		6	ABC DC#1	1.633	34	137	127	68.99	279.22	58.14	79.52	(21.38)	3rd	4	361.45
15		5	ABC DC#1	1.633	35	206	196	70.72	279.22	59.85	79.52	(19.67)	3rd		
16		7	ABC DC#1	1.633	39	138	127	77.65	279.22	66.69	79.52	(12.83)	3rd	5	452.39
17		7	ABC DC#1	1.633	41	212	202	81.12	279.22	70.11	79.52	(9.41)	3rd		
18		7	ABC DC#1	1.633	50	126	115	96.72	279.22	85.50	79.52	5.99	3rd	5	453.68
19		4	ABC DC#1	1.633	56	131	124	107.12	279.22	95.76	79.52	16.25	3rd	2	181.75
20		6	ABC DC#1	1.633	57	173	102	108.85	279.22	97.47	79.52	17.96	3rd		
21		7	ABC DC#1	1.633	57	122	112	108.85	279.22	97.47	79.52	17.96	3rd	5	454.49
22		7	ABC DC#1	1.633	59	151	84	112.32	279.22	100.89	79.52	21.38	3rd		
23		6	ABC DC#1	1.633	59	140	67	112.32	279.22	100.89	79.52	21.38	3rd		
24		6	ABC DC#1	1.633	59	151	84	112.32	279.22	100.89	79.52	21.38	3rd		
25		7	ABC DC#1	1.633	60	141	96	114.05	279.22	102.60	79.52	23.09	3rd		
26		6	ABC DC#1	1.633	60	227	216	114.05	279.22	102.60	79.52	23.09	3rd		
27		7	ABC DC#1	1.633	61	231	221	115.79	279.22	104.31	79.52	24.80	3rd		
28		7	ABC DC#1	1.633	62	229	219	117.52	279.22	106.02	79.52	26.51	3rd		

29		7	ABC DC#1	1.633	63	120	121	119.25	279.22	107.73	79.52	28.22	3rd	5	455.19
30		6	ABC DC#1	1.633	64	170	97	120.99	279.22	109.44	79.52	29.93	3rd		
31		4	ABC DC#1	1.633	64	116	111	120.99	279.22	109.44	79.52	29.93	3rd	2	182.12
32		6	ABC DC#1	1.633	64	135	135	120.99	279.22	109.44	79.52	29.93	3rd		
33		7	ABC DC#1	1.633	65	235	224	122.72	279.22	111.15	79.52	31.64	3rd		
34	7		YZ DC#1	1.633	67	111	75	126.19	279.22	114.57	79.52	35.06	3rd		
35		7	ABC DC#1	1.633	67	123	123	126.19	279.22	114.57	79.52	35.06	3rd	5	455.66
36		5	ABC DC#1	1.633	67	121	122	126.19	279.22	114.57	79.52	35.06	3rd	3	273.40
37		7	ABC DC#1	1.633	68	123	124	127.92	279.22	116.28	79.52	36.77	3rd	5	455.78
38		6	ABC DC#1	1.633	68	135	74	127.92	279.22	116.28	79.52	36.77	3rd	4	364.62
39		6	ABC DC#1	1.633	68	108	110	127.92	279.22	116.28	79.52	36.77	3rd	4	364.62
40		7	ABC DC#1	1.633	69	123	112	129.65	279.22	117.99	79.52	38.48	3rd	5	455.89
41		7	ABC DC#1	1.633	69	111	112	129.65	279.22	117.99	79.52	38.48	3rd	5	455.89
42		5	ABC DC#1	1.633	69	135	135	129.65	279.22	117.99	79.52	38.48	3rd		
43		6	ABC DC#1	1.633	70	105	106	131.39	279.22	119.70	79.52	40.19	3rd	4	364.81
44		7	ABC DC#1	1.633	71	129	119	133.12	279.22	121.41	79.52	41.90	3rd	5	456.13
45		6	ABC DC#1	1.633	71	107	110	133.12	279.22	121.41	79.52	41.90	3rd	4	364.90
46		7	ABC DC#1	1.633	72	140	80	134.85	279.22	123.12	79.52	43.61	3rd		
47		7	ABC DC#1	1.633	74	124	99	138.32	279.22	126.54	79.52	47.03	3rd		
48		6	ABC DC#1	1.633	74	103	109	138.32	279.22	126.54	79.52	47.03	3rd		
49		7	ABC DC#1	1.633	75	126	71	140.05	279.22	128.25	79.52	48.74	3rd		
50		6	ABC DC#1	1.633	76	232	153	141.79	279.22	129.96	79.52	50.45	3rd		
51		7	ABC DC#1	1.633	76	100	103	141.79	279.22	129.96	79.52	50.45	3rd		
52		4	ABC DC#1	1.633	77	106	107	143.52	279.22	131.67	79.52	52.16	3rd		
53		4	ABC DC#1	1.633	78	99	107	145.25	279.22	133.38	79.52	53.87	3rd		
54		7	ABC DC#1	1.633	79	116	88	146.99	279.22	135.09	79.52	55.58	3rd		
55		5	ABC DC#1	1.633	79	100	110	146.99	279.22	135.09	79.52	55.58	3rd		
56		6	ABC DC#1	1.633	80	105	103	148.72	279.22	136.80	79.52	57.29	3rd		
57		5	ABC DC#1	1.633	80	99	109	148.72	279.22	136.80	79.52	57.29	3rd		
58		7	ABC DC#1	1.633	80	98	108	148.72	279.22	136.80	79.52	57.29	3rd		
59		5	ABC DC#1	1.633	80	102	104	148.72	279.22	136.80	79.52	57.29	3rd		
60	7		YZ DC#1	1.633	81	113	62	150.45	279.22	138.51	79.52	59.00	3rd		
61		5	ABC DC#1	1.633	81	97	107	150.45	279.22	138.51	79.52	59.00	3rd		
62		4	ABC DC#1	1.633	81	99	109	150.45	279.22	138.51	79.52	59.00	3rd		
63		7	ABC DC#1	1.633	82	102	104	152.19	279.22	140.22	79.52	60.71	3rd		
64		5	ABC DC#1	1.633	82	94	101	152.19	279.22	140.22	79.52	60.71	3rd		
65		4	ABC DC#1	1.633	82	99	109	152.19	279.22	140.22	79.52	60.71	3rd		
66		7	ABC DC#1	1.633	83	99	110	153.92	279.22	141.93	79.52	62.42	3rd		

As discussed above and supported by Table 13 and Table 14, there are an average of 99 inbound loads per week carried by third party trucks arriving in ABC DC#1 with dry groceries.

As a result, the maximum number of outbound loads relying on third party carriage should be at

most 99, if it were slightly less there would be a greater margin of safety. In the table, if a store is profitably served by a third party carrier, and on a route of the region, its weekly delivery quantity is ascertained and its weekly savings are calculated. Once there are close to 99 loads scheduled for delivery by third party carriers, (in this case there were 93), that is sufficient and no more loads will be added. This is another reason for the abbreviated list of stores shown in the table.

After calculating the costs associated with serving each store using each carrier, the total overall costs and savings can be compared. For YZ, the wholesale supplier, the cost of delivering the load is just a percentage of the value of the load (regardless of total mileage). In the case of the third party carrier, both the costs and resultant savings are calculated. While some of the stores received up to 7 deliveries per week, it is assumed that inbound deliveries carried by third party transportation providers only arrive on weekdays. As a result, the days on which the DC can use third party carriers for outbound loads are limited to a maximum of five. The comparable costs are depicted below in Table 16: Third Party Carrier For Outbound – Sample Potential Savings.

**Table 16: Third Party Carrier For Outbound – Sample Potential Savings**

	<b>ABC DC #1 Grocery</b>	<b>ABC DC#1 Frozen</b>	<b>ABC DC#2</b>
<b>Total Weekly Loads</b>	93	17	17
<b>Weekly Savings</b>	\$8,291	\$1,015	\$1,243
<b>Annual Savings</b>	\$431,145	\$52,797	\$64,673
<b>Savings - \$/load</b>	\$89	\$59	\$73

The analytical results show that ABC grocer could realize significant savings by increasing its utilization of third party carriers for the delivery of outbound loads to stores. While the idea of a cost savings opportunity is generally good news, the calculations in

Table 15 are thought provoking since they indicate a third party carrier would be the low-cost carrier to the majority of stores within the network; it raises the question of the relevance and appropriateness of maintaining a private fleet.

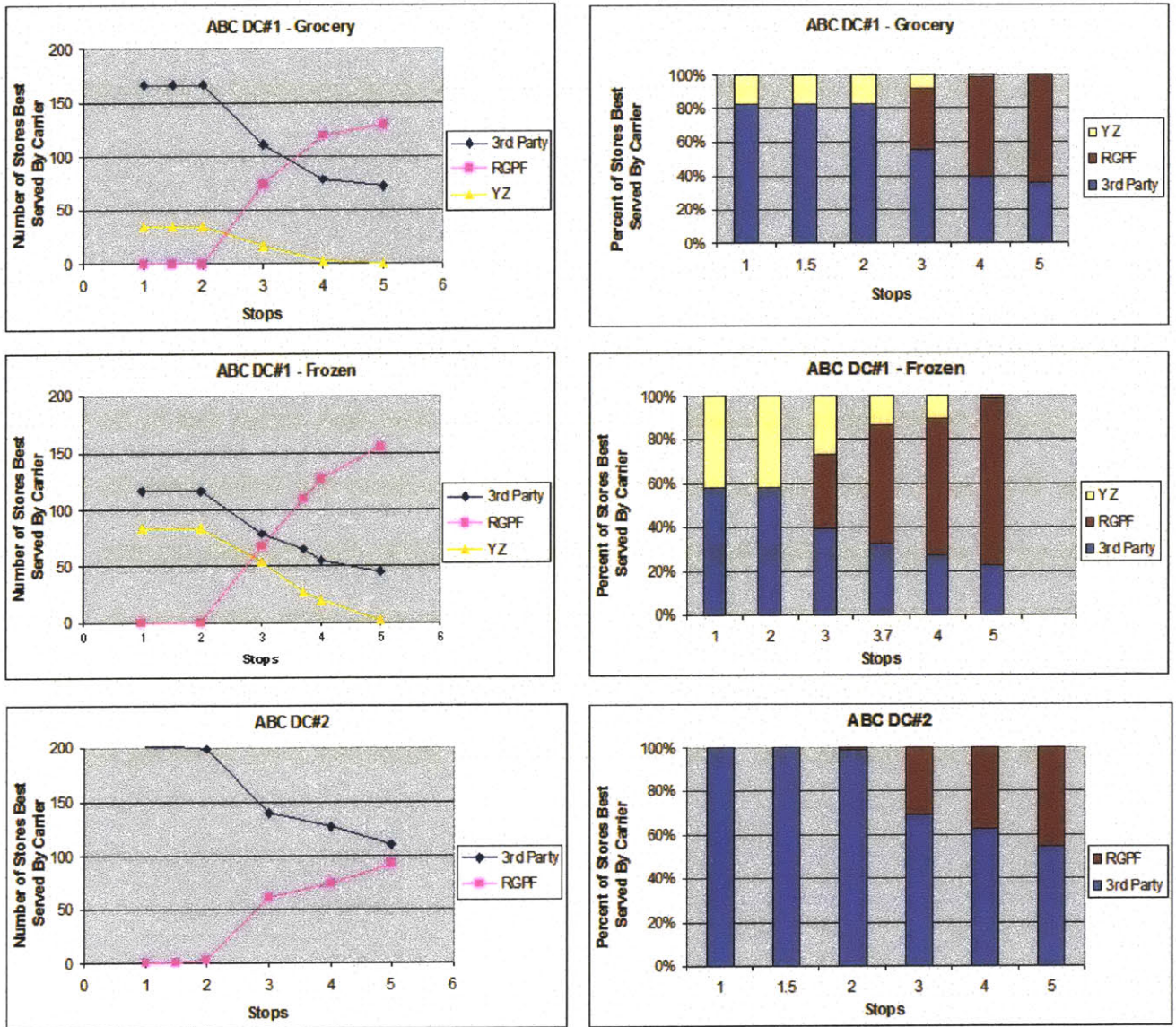
After modeling the potential cost savings for each of the dry grocery, frozen, and perishable DCs, the most significant cost-savings opportunity is indicated for the dry grocery operations at ABC DC#1. One point of differentiation is that this DC receives the greatest number of regular deliveries per week from third party carriers; the frozen operation is smaller while the perishable operation is more variable. Additionally, carriers delivering to the dry grocery DC would tend to be the most likely to solicit return trip business, and the model takes this into account by only considering carriers eligible for the project if they are coming from within or nearby the chain's operation region, but not from another area of the country. Carriers selected as eligible for consideration, were primarily traveling between 200 and 600 miles, none of the carriers traveling greater than 1000 miles were considered. This judgment was made based on the assumption that trans-continental carriers were conducting business on a much larger scale and would not consider adding a trip of less than 200 miles worth the time and effort of coordination.

Upon examination of the model parameters, one other distinct feature between DCs is the number of stops on a trip. While dry grocery and frozen operations out of DC#1 experience similar seasonality of demand (lower than that for perishable), the average number of stops per frozen load is 3.7 compared to 1.5 for dry grocery. To explore this idea, additional analysis was conducted to determine the sensitivity of projected carrier costs (and resulting carrier choice) to

the number of stops per load out of each DC. This analysis indicated that total cost is very sensitive to the number of stops on each load and drives the results presented in this section.

In

Table 15: Third Party Calculations, with the given parameters the calculations indicate that all of the stores included in the table would be better served by a third party carrier than by the private fleet. If the entire table of results were displayed, it would indicate that farther down the table, there are 35 stores which show that they would be best served by YZ wholesale supplier. Along these lines, the results of the sensitivity analysis display how many of the approximately 200 stores would be best served by each carrier choice, depending on the average number of stops per load on a trip from each DC. The results are depicted graphically in the following figures.



**Figure 14: Sensitivity of Carrier Choice to Stops Per Load**

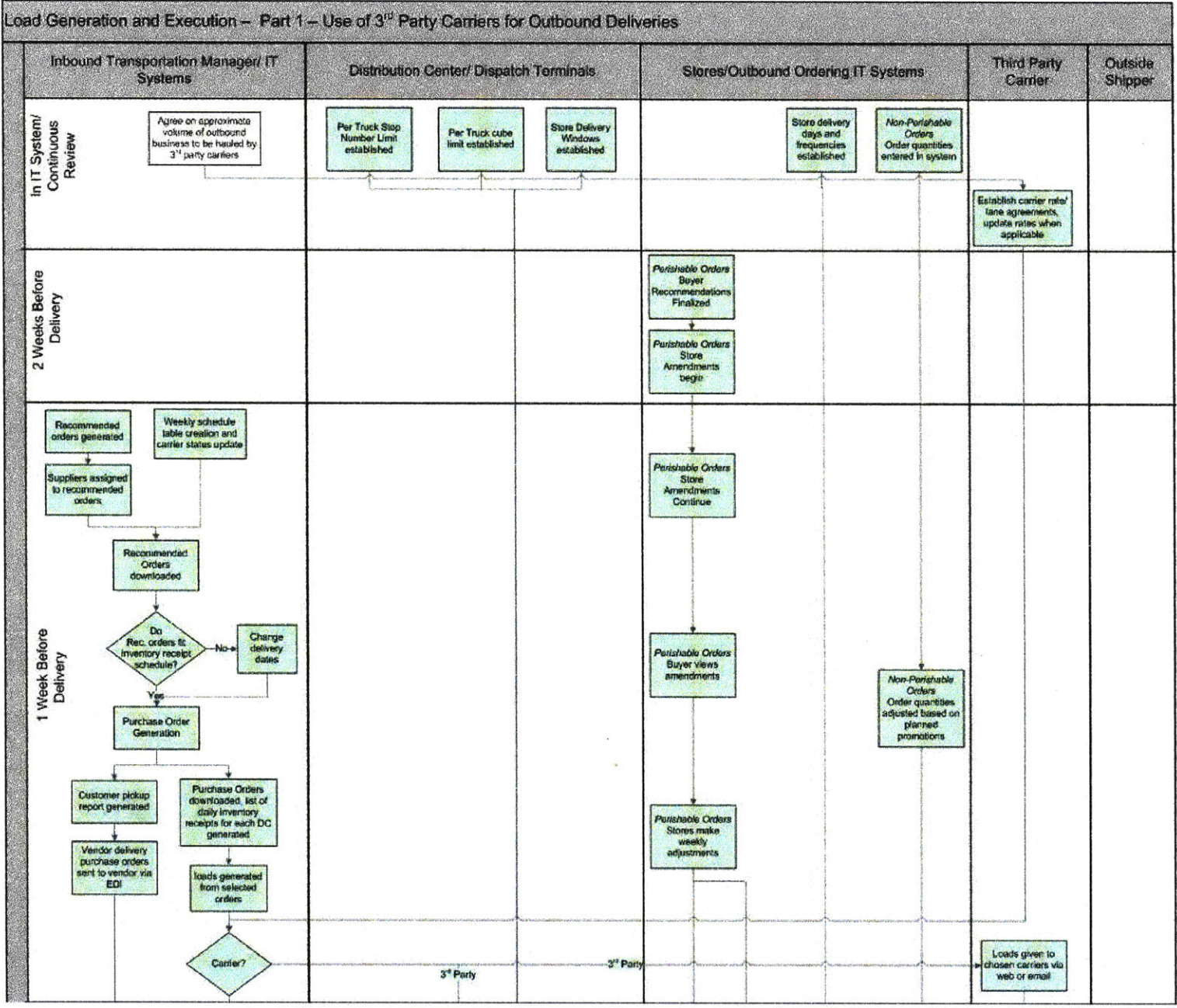
The graphs in Figure 14: Sensitivity of Carrier Choice to Stops Per Load show that the frozen operations out of ABC DC#1 are best served by the private fleet while there are more than 3 stops per load, which is in fact the case. The graphs also show that while the dry grocery operation out of ABC DC#1 continues to average 1 to 2 stops per load, it will remain profitable to use a third party carrier to do some of the outbound deliveries. The graphs indicate that it would be beneficial to use a third party carrier to deliver some outbound loads out of DC#2 as

well. This conclusion is supported by the analysis presented in Table 16: Third Party Carrier For Outbound – Sample Potential Savings, though as previously discussed, there is more variability associated with the seasonality of the perishable products at this DC, so implementation will be more complex.

Overall, there are clearly substantial opportunities for savings with the increased utilization of third party carriers, especially at the dry grocery DC, (DC#1). The savings presented in Table 16 are representative of the fact that the stores and carriers are only a sample set of the nodes within the ABC network. If the savings demonstrated by the calculations in this section are attained, ABC will realize savings equal to greater than 1% of total annual freight costs.

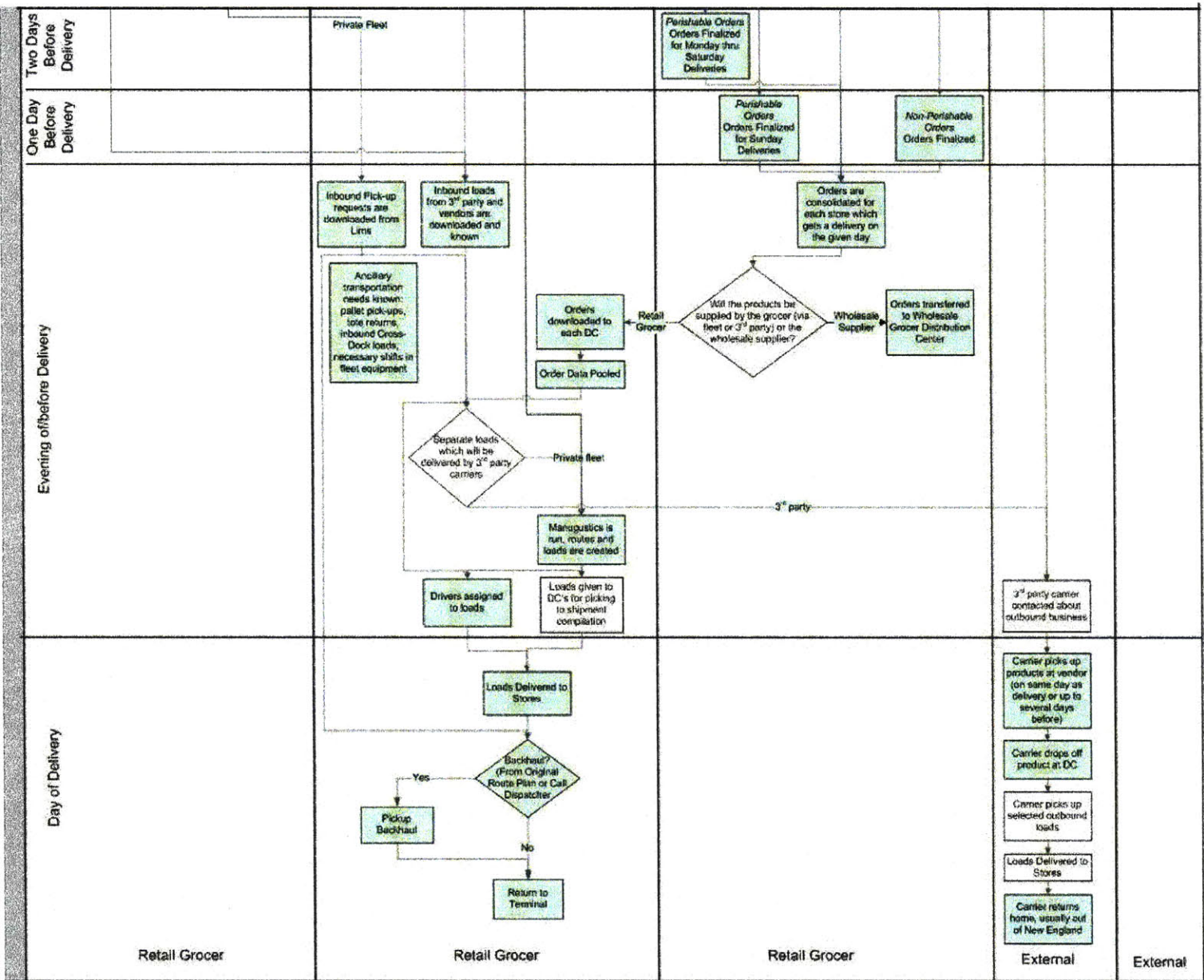
### ***Section 5: Implementation***

Utilizing third party carriers to deliver loads outbound to stores would be a significant decision and involve additional planning and coordination by ABC and its carrier partners. The timeline for decision making throughout the supply chain should be examined and revise when needed. A possible new structure is outlined in Figure 15: Process Flow Chart - Incorporating Third Party Carriers for Outbound Deliveries (Top Half) and Figure 16: Process Flow Chart - Incorporating Third Party Carriers for Outbound Deliveries (Bottom Half) below. The elements of these two diagrams which are different from the basic diagram in Figure 9: Information Flows Through the Transportation System (Top Half) and Figure 10: Information Flows Through the Transportation System (Bottom Half) are differentiated because they are unshaded blocks in the diagrams.



**Figure 15: Process Flow Chart - Incorporating Third Party Carriers for Outbound Deliveries (Top Half)**

Figure 16: Process Flow Chart - Incorporating Third Party Carriers for Outbound Deliveries (Bottom Half)



## **Chapter 4: Process Planning With Backhauls**

### ***Section 1: Background***

The retailer's private fleet currently delivers groceries to the stores within the network as described in Chapter 2: Current Operations. The fleet often picks up inbound deliveries to backhaul them to the DC after completing a load of store deliveries. The current practice to coordinate backhauls normally runs in one of two ways, both of which are completed independently of the outbound store delivery load planning and routing. Outbound loads are routed using Manugistics software to create full truckloads, combining loads to various store destinations and keeping the total load within a specified pallet and cube limit. The software runs each evening to generate routes for the following day.

Once the delivery routes are created, they are printed for the dispatchers and drivers who assign drivers dynamically throughout the day. If a backhaul is known when the drivers are dispatched, the dispatcher will assign the backhaul to a driver who is making deliveries near to the backhaul pickup location. Alternately, if the backhauls are not known ahead of time, the driver will call the dispatcher after completing deliveries to learn if there are any nearby backhauls to pick up.

Interestingly, the backhauls are inbound orders, all of which are scheduled the week before by the inbound transportation managers. This is an opportunity for enhanced coordination because all of the required information exists within the retailer's network several days before the transportation occurs, even if it is currently not always available to all who need it.

## ***Section 2: Constraints***

To create efficient routes, inbound and outbound loads to be carried by the retail grocers fleet should be planned together through centralized operations. Initially, static routes can be created so that inbound pickup points are permanently associated with stores in a particular delivery area. Simultaneously, information flows need to be examined to facilitate appropriate information sharing so that inbound and outbound loads can be coordinated in the trip planning stage.

To create static routes, each route should be examined; routes for each DC should be considered separately. Several factors will be associated with the selection of dispatch location and route for examination. For example, the variability of the volume of traffic at each dispatch location will affect the ability to create static routes; at some DCs the volume of loads is much higher during holiday seasons. If the carrier has the capacity to move the load at the low point of its demand volume, but uses all of its assets just to satisfy in-house delivery requirements during peak demand times, then the backhauls will not get picked up during these times. On the other hand, efficient routing will better utilize RGPF resources at peak times, perhaps better enabling the retailer to satisfy demand at these times as well.

While the DCs which experience smaller fluctuations in demand are easier to schedule into static routes, they also stand to realize smaller benefits from the increases in efficiency. The pros and cons associated with transportation planning strategies for each DC are summarized in Table 12: DC Characterization.

## ***Section 3: Planning***

### **Section 3.1: Static Routes**

A methodology will be created to design static backhaul routes; these routes will become an established link between backhaul pickup locations and store delivery points. To select the stores which should be associated with a given backhaul location, each backhaul location should be analyzed. The initial analysis should focus on the vendors with highest volume and frequency of backhauled loads. For each selected vendor, a list will be made of the 5 stores which are closest to the vendor and their distance, in on-road miles, from the vendor's pickup location. Scheduling issues will also be considered when creating routes which include backhauls; the store nearest to the backhaul location must be the last stop on the trip so that the truck is empty, and the time windows for store delivery and vendor pick-up must be compatible with the route schedule.

The store-to-backhaul-location relationships will now be permanently associated, so that when orders are placed for the week and inbound loads balanced across days, one of the factors in the load balancing will be the outbound route the vendor is associated with. In this way, it will be guaranteed that the vendor pickup day is one when a nearby store will be getting a delivery and the backhaul will be easily and efficiently completed after the store delivery is made.

For instance if there is an ABC store in Smallville and a cereal manufacturer in Smallville which ships products to ABC DCs, the store and manufacturing facility will be permanently associated. Each time a Smallville Cereal load is ready to be picked up, (and scheduled to be picked up by RGPF, not delivered by the vendor or a third party carrier), it will

be scheduled on a day that the Smallville ABC store gets a delivery. Additionally, the Smallville store will be the last stop on the route so that the truck is empty and ready to pick up the cereal backhaul. Figure 17: Process Map – Route Planning With Backhauls (Top Half) and Figure 18: Process Map – Route Planning With Backhauls (Bottom Half) illustrate the flow of information decisions processes involved in planning backhauls. The elements of these two diagrams which are different from the basic diagram in Figure 9: Information Flows Through the Transportation System (Top Half) and Figure 10: Information Flows Through the Transportation System (Bottom Half) are differentiated because they are unshaded blocks in the diagrams.

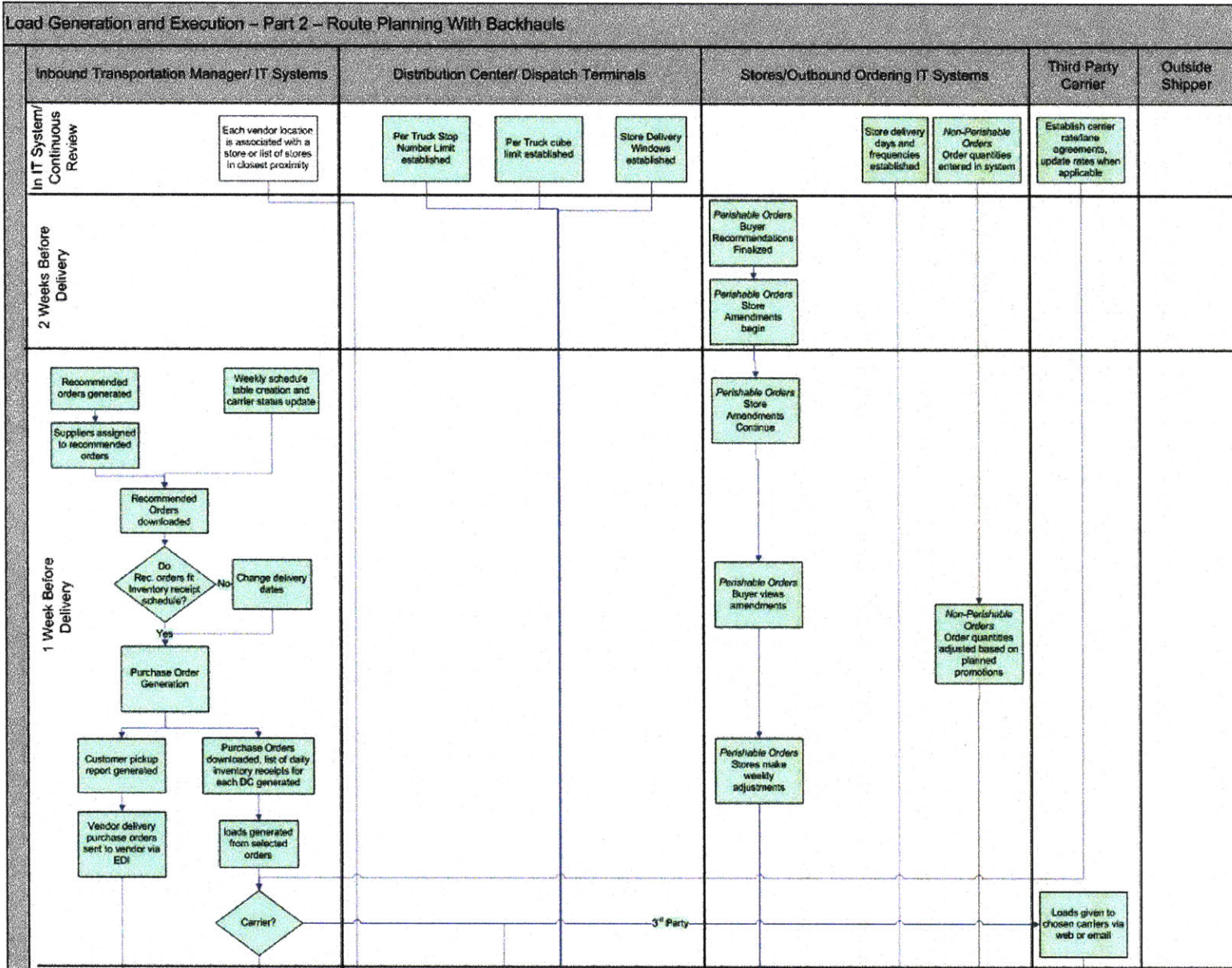
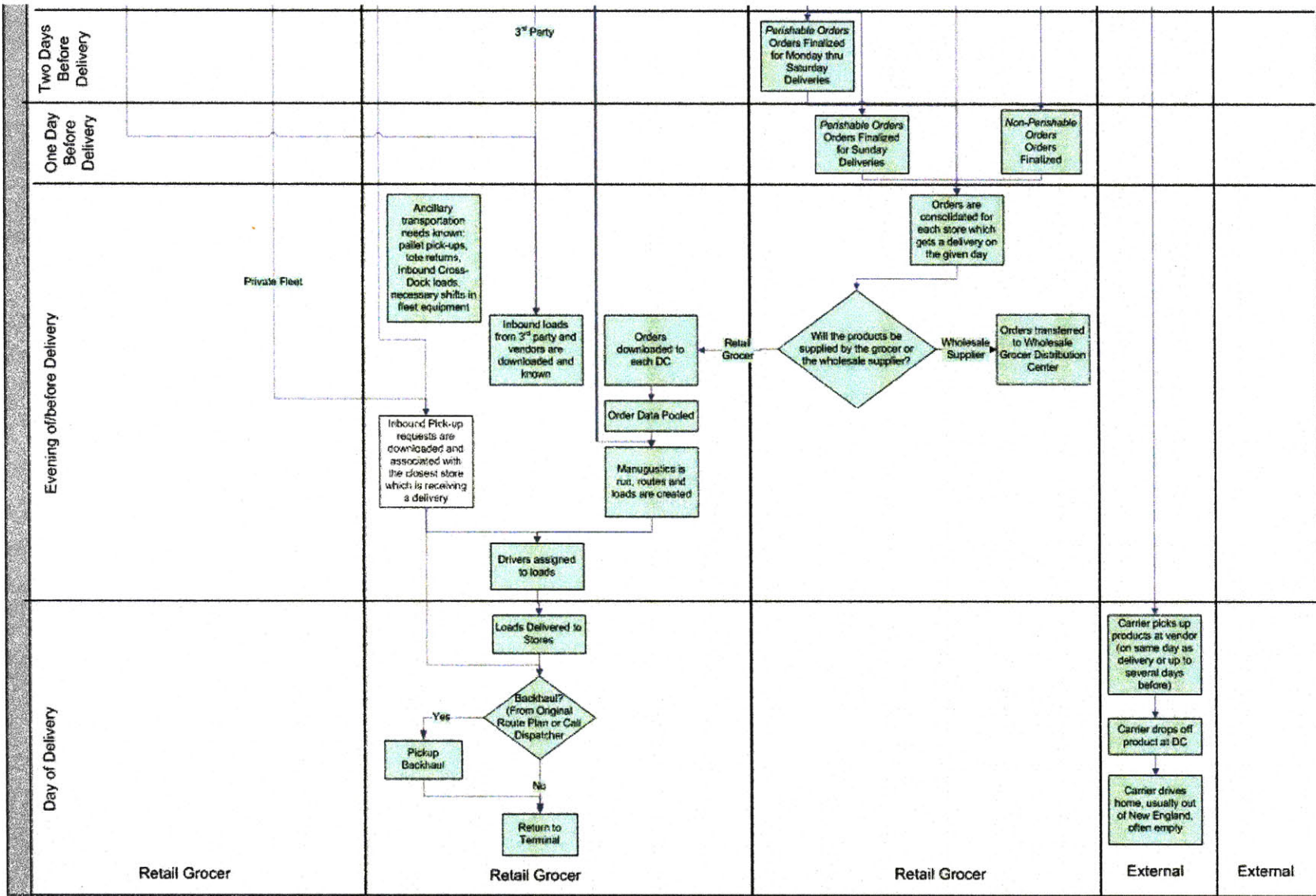


Figure 17: Process Map – Route Planning With Backhauls (Top Half)

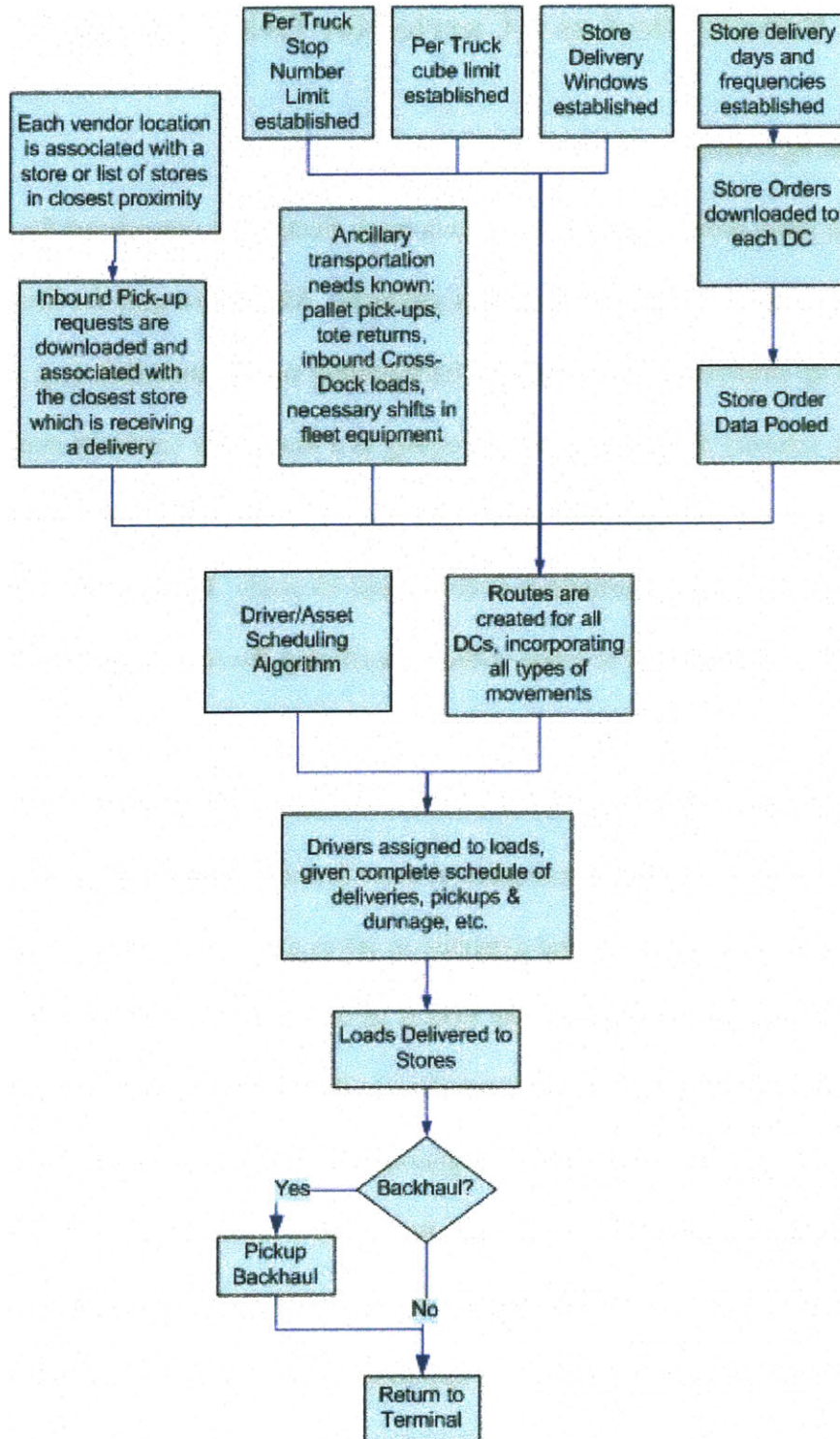
Figure 18: Process Map – Route Planning With Backhauls (Bottom Half)



### **Section 3.2: Central Dispatching/ Dynamic Routes**

Once the process of creating static routes has been established and the routes are operating effectively, a system of creating dynamic routes can be developed. The capability for creating dynamic routing will be facilitated by the increase in information availability which will be critical to a central dispatching operation. Each day, opportunities for coordination between inbound and outbound movements will be identified and exploited. The objective is to look at the entire network as a whole and efficiently match inbound loads, outbound loads, and resources across the entire network; this may be done at the separate dispatch locations or at one central dispatching location.

To create the dynamic routes, information will be gathered regarding all inbound and outbound loads, the previously created static routes, and the available assets or resources to transport the loads. Each day, (operators or IT systems at) the central dispatch location will examine all of the information and create a list of routes, matched to assets, which results in the lowest total costs and miles traveled. A graphical depiction to the planning process to create dynamic routes is represented in Figure 19: Planning Dynamic Routes to Incorporate Backhauls. Further research will be required to define the complete process changes necessary for implementation. In this project, there were not sufficient detailed data available on past backhaul activity to perform a complete analysis.



**Figure 19: Planning Dynamic Routes to Incorporate Backhauls**

The coordination of backhauls can be taken one step further by incorporating loads for which RGPF acts as a carrier for outside shippers; this idea is explored in the next chapter.

## Chapter 5: Private Fleet as a Carrier for Other Shippers

### *Section 1: Background*

In recent years many companies that own truck fleets have considered the option of using the fleet to do more than just deliver their own products. Alternative uses for the fleet might include picking up shipments from suppliers, backhauling surplus materials (e.g. pallets, damaged goods, returns) from stores, or even acting as a third party carrier to another shipper. For example, Frito-Lay, the American snack food giant with its own private fleet for store delivery, has explored such opportunities over the past 10 years. Frito-Lay has selected specific routes which yield supplemental revenue without sacrificing the service and quality their brand image relies on.<sup>6</sup>

ABC uses a fleet which is a wholly owned subsidiary of the grocery company. As long as the fleet has more than sufficient resources to meet demand, fleet managers may consider using their transportation resources and expertise to act as a carrier for other organizations and attain additional revenue. Since the private fleet is its own entity, it should act in a way to maximize total profits. Historically, ABC reimburses RGPF for all of its expenses, so the fleet does not necessarily act as a profit-seeking organization. The goal of the fleet is to provide high quality service to deliver all needed loads from the grocer's DCs to retail stores on exactly the day needed. A high level of service is attained, but not necessarily by utilizing a minimum cost strategy. In this case, the strategy misses an opportunity to offset some cost with external revenue.

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<sup>6</sup> "Frito-Lay: The Backhaul Decision," Harvard Business School Case 9-688-104, 1988.

## ***Section 2: Constraints***

Fleet managers found themselves with an asset base underutilized in many return trips. Part of the underutilization was a location issue; the retailer only has stores within one region of the country but receives products from vendors located all over the country. Since the private fleet only operates within this region, backhaul opportunities are limited to vendors within the new England, for whom it is cheaper to pick up the product with the private fleet then to utilize vendor delivery services or hire a third party carrier. In addition, some of these stores are sufficiently remote that it is not possible for a driver to deliver to a store, return to the DC, and then deliver another load because he has already used most of his driving hours for the day.

## ***Section 3: Planning & Analysis***

Backhaul opportunities fall into one of three categories:

- **Traditional backhaul** – Private fleet delivers goods from DC to stores and then stops at a vendor to pick up a load and brings it back to the DC (this option and surrounding opportunities are discussed earlier in Chapter 2: Current Operations.
- **Within Network** – Private fleet carries products from a vendor’s pickup location to the DC of its wholesale supplier, this would be different because the private fleet would be taking products to the wholesaler’s DC and not its own DC.
- **Outside Network** – Private fleet transports product within another shipper’s network, for example: from a manufacturer’s pick-up location to its DC or from a regional DC to smaller DC. Both the points of origin and destination are not within the retailer grocer’s network of stores and DCs. Even though the manufacturer may be a vendor which

supplies ABC, the transportation services provided would not bring goods from the vendor’s network into the ABC’s network.

Since location limits backhaul opportunities, the partner company is currently investigating non-traditional backhaul opportunities which fit within the realm of operations of the private fleet. Various route structures could be utilized, as indicated in Table 17: Possible Routes.

**Table 17: Possible Routes**

Traditional Backhaul	DC/Terminal – store deliveries – backhaul pickup – DC/Terminal
Within Network	DC/Terminal – Vendor – Wholesaler DC – store deliveries – DC/Terminal
Within Network	DC/Terminal – Vendor – Wholesaler DC – backhaul pickup – DC/Terminal
Within Network	DC/Terminal – shipper A Pick-up Point – shipper A drop-off point – cross-dock – store deliveries - DC/Terminal
Within Network	DC/Terminal – Store Deliveries – shipper A Pick-up point – shipper A drop-off point – DC/Terminal
Outside Network	DC/Terminal – shipper A Pick-up Point – shipper A drop-off point – DC/Terminal

One of the challenges in the retailer’s network is that there are a variety of store locations in relatively remote locations in part of its operating area but very few backhaul opportunities are located in those vicinities. Any carriage opportunities to generate revenue with otherwise unused time and miles in these areas would be favorable since empty miles traveled would be reduced and revenues increased, without a drastic increase to total miles traveled or total cost.

To capitalize on the fleet’s own assets and location, RGPF can first target shippers within the states where remote ABC stores are located. If there are organizations which need transportation services in these areas and RGPF has excess capacity, the organizations could be a good match. Before agreeing to act as a carrier for these companies, several factors should be

considered. First, RGPF must be sure that carrying these loads will not interfere with its obligation to deliver groceries to stores, its primary responsibility. Second, fleet managers must be sure that demand fluctuations throughout the week and throughout the year will not inhibit its ability to service potential new customers. Third, if in-network deliveries and backhauls are part of the routes under consideration, RGPF obligations must be considered so that scheduling and capacity conflicts are avoided. If a route is economically feasible because it incorporates a backhaul within ABC network, the value proposition could be undermined if scheduling constraints are not considered in route execution.

#### ***Section 4: Implementation***

Many issues must be considered to implement this proposition, one will be the nature of the agreement between ABC, RGPF, and the outside shippers. They might decide to establish (long or short-term) contracts or simply respond to demand as it arises. Obviously this facet of route planning must also be included in the overall transportation plan; a revised planning process which includes the coordination of carriage of outside shipper loads by the private fleet is illustrated in Figure 20: Process Flow - Private Fleet Acts as Shipper (Top Half) and in Figure 21: Process Flow - Private Fleet Acts as Shipper (Bottom Half). The elements of these two diagrams which are different from the basic diagram in Figure 9: Information Flows Through the Transportation System (Top Half) and Figure 10: Information Flows Through the Transportation System (Bottom Half) are differentiated because they are unshaded blocks in the diagrams.

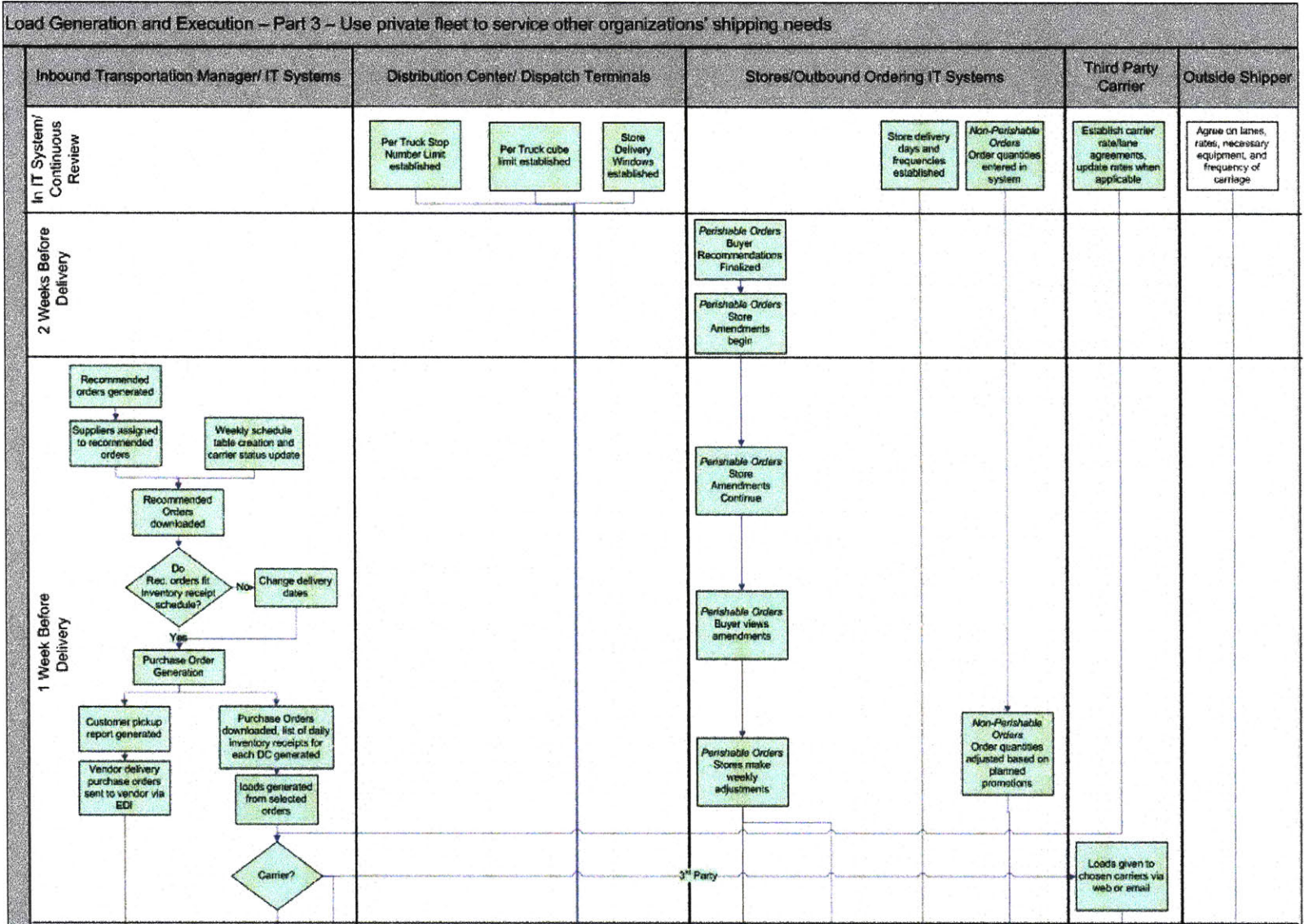
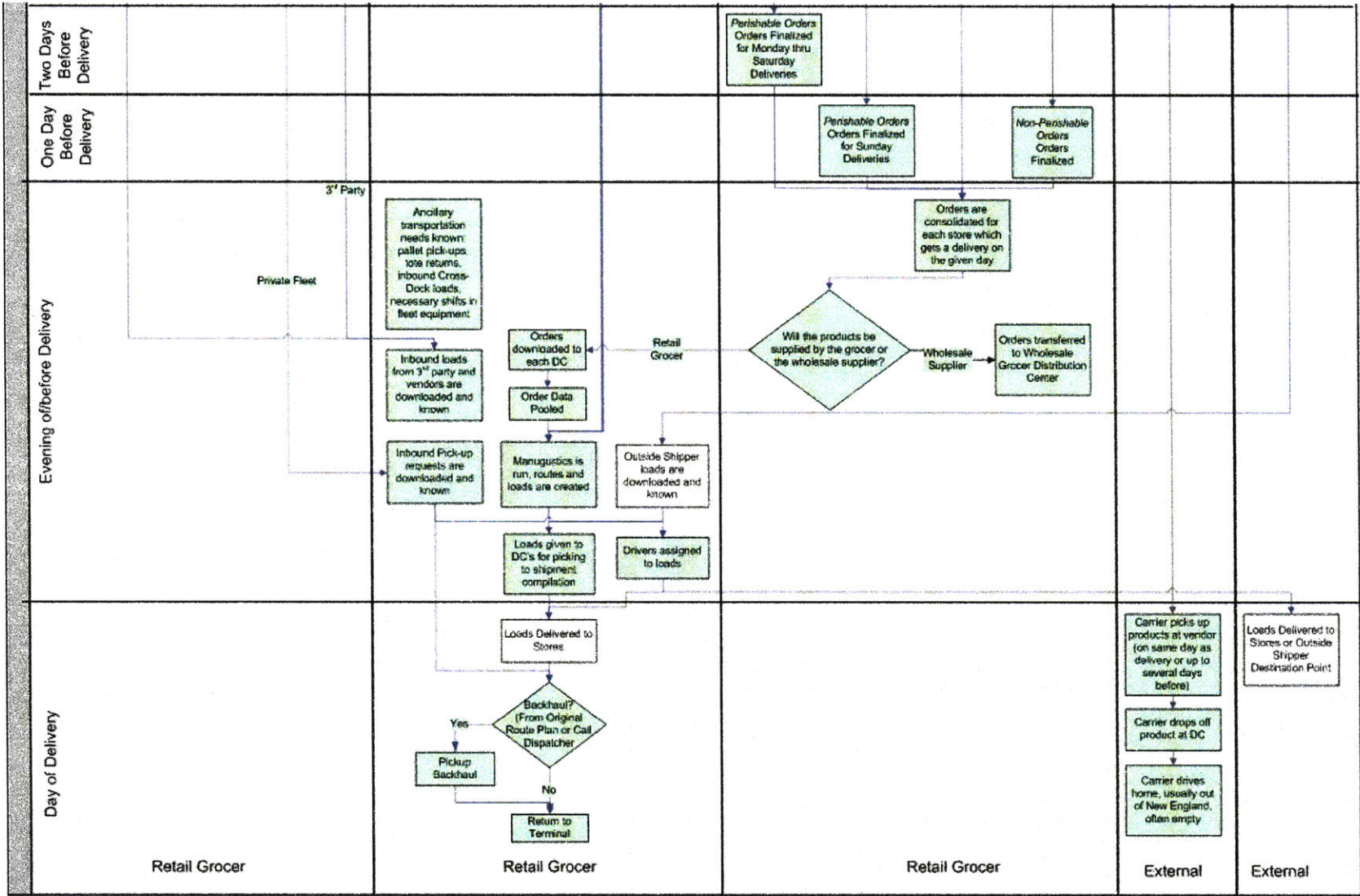


Figure 20: Process Flow - Private Fleet Acts as Shipper (Top Half)

Figure 21: Process Flow - Private Fleet Acts as Shipper (Bottom Half)



## **Chapter 6: Integration and Central Dispatch**

### ***Section 1: Benefits of Integration***

Chapters 3 through 5 have outlined a detailed exploration of several possible strategic changes in managing the transportation network for a retail grocer. The changes involve utilizing third party carriers to deliver outbound loads to stores, planning to coordinate backhaul movements, and acting as a carrier for other shippers. Each of these potential changes provides ABC with some opportunities for cost savings or improved efficiencies but always leads to increasingly detailed planning processes.

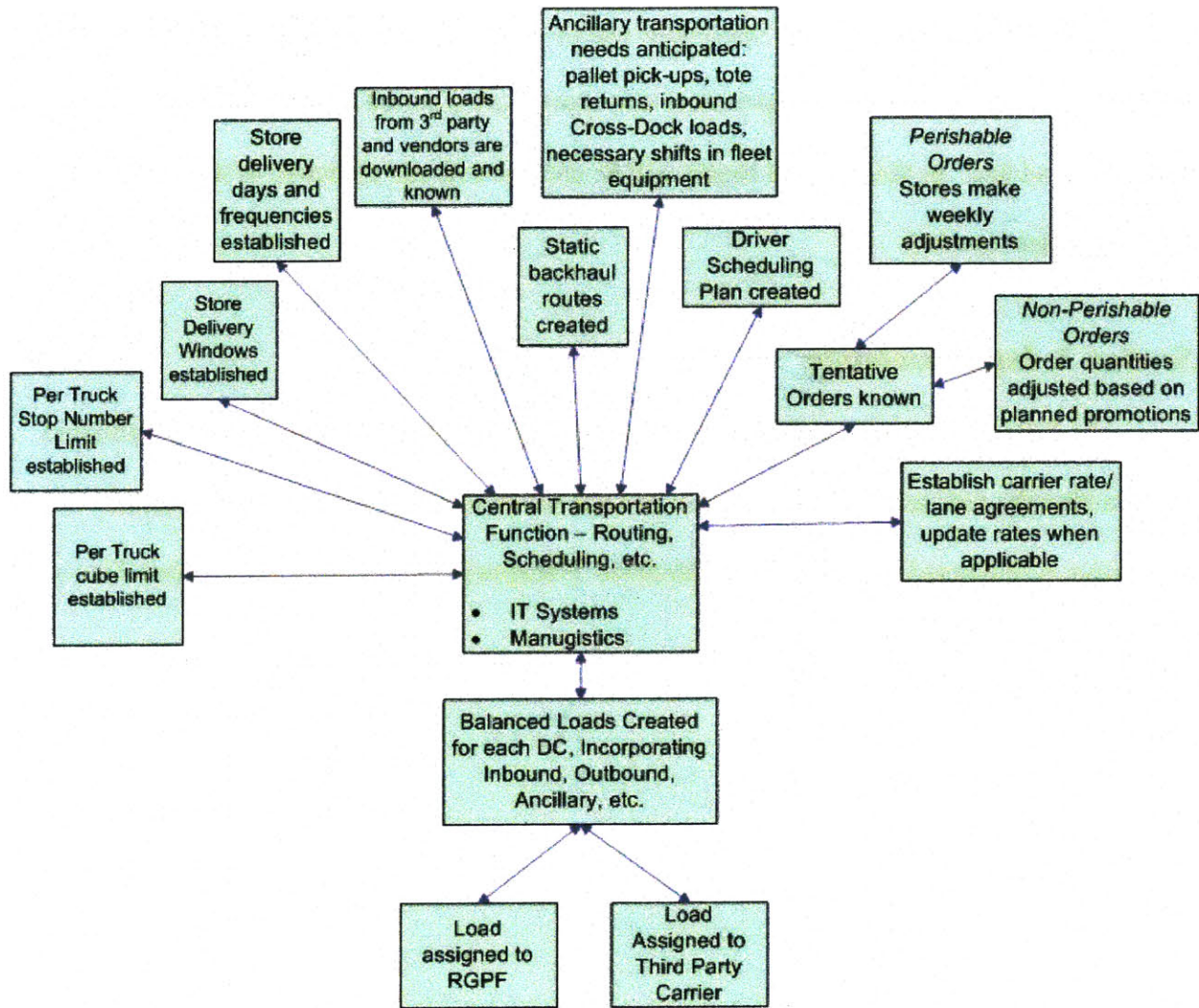
To effectively and efficiently plan all the movements with the transportation network, it would be easiest if all loads were routed while looking at the system as a whole (not just one DC at a time) and if all transportation needs were examined together. Inbound, outbound and other movements must all be considered when vehicles and drivers are assigned to loads for a specific day. The majority of the information needed to assign drivers to loads is available ahead of time; this fact could be exploited by moving some of the planning functions to an earlier stage in the transportation process.

Currently, some transportation planning is conducted in a decentralized manner at each dispatch location, while other planning occurs at headquarters. A centralized planning function will help ABC take advantage of all available information in a timely manner. A centralized planning function will help ABC to look at the 'big picture' with respect to transportation operations so that it may look at all route and carrier options and then pick the best ones. Most importantly, information must be compiled and used in aggregate. Ideally, routes will be planned up to one week in advance, the earliest point at which most relevant information is available.

The key observation is that operations can be most efficient when information is shared, farther in advance, so that all transportation movements are planned ahead of time, and not determined ad hoc. In this way, all routes will be created with the objective of minimizing cost and total miles traveled.

### ***Section 2: Implementation***

To fully implement a centralized, integrated planning process, some of the information flows within the network will need to be examined and potentially revised. One possible alternative is illustrated in Figure 22: Centralized Transportation Planning Information Flows.



**Figure 22: Centralized Transportation Planning Information Flows**

Instead of the current, fragmented progress in which carriers are chosen at various stages in the process, all routes and transportation needs could be planned and tentatively created, and then a carrier chosen based on those needs. Several days before delivery, the demand for transportation services will be known, including:

- Delivery of orders to stores
- Pickup of inbound goods at vendor locations
- Ancillary – pallets, dunnage, equipment movement, etc.
- Carrier services for outside shippers

Looking at the demand for transportation, as well as the other system parameters such as driver planning guidelines, store delivery restrictions, etc, the available resources will be matched to loads. (Driver planning guidelines are discussed in detail the thesis titled Transportation Resource Scheduling in the Grocery Industry, written by Arzum Akkas) The available carriers will be:

- Private fleet
- Third party carriers who are due in to the DCs with inbound loads
- Third party carriers in the area, available for contract hire for outbound loads

An appropriate carrier will be chosen and hired if needed. One day before delivery, the routes will be finalized and any necessary resource adjustments will be made. As changes occur, dynamic adjustments will be made.

### ***Section 3: Challenges***

In an planning process change, there are many foreseeable challenges. Most of the ideas discussed in this document propose altering the transportation planning process to move decisions further back in the schedule. In this way, most routes and loads are known several days in advance so that resources can be assigned and hired accordingly; at same time the ability to adjust the plan up to the night before is maintained. To facilitate the earlier planning of loads and carriers, information must be available in a timely manner to all those who need it.

Inbound transportation managers will need to adjust scheduled delivery says to guarantee coordination between inbound and outbound loads. To enable this efficiency, outbound transportation information about anticipated store orders must be visible to the inbound coordinators. Additionally, planners must keep in mind all of the ancillary needs for RGPF

transportation services within the ABC network, such as moving, pallets, dunnage and relocating equipment.

Inevitably, parts of the plan and transportation demands will change as the delivery date approaches. If these changes are not handled in a straightforward manner, the planning process will not help the company. As outbound transportation managers realize the order volume is increasing and more trucks will be needed, they must communicate this with inbound managers. If all the transportation functions within the company openly share their ideas and foreseeable changes, the entire process will be much more effective.

When considering any change, the cost of implementation must also be considered. To fully evaluate the feasibility of these ideas, ABC should determine how much work will be required to plan and coordinate these strategies, both for initial implementation and then for daily execution.

#### ***Section 4: Summary & Conclusions***

Overall, there are many opportunities to take advantage of network characteristics to improve overall efficiency, reducing total cost and total empty miles traveled. As discussed throughout the document, the key steps will be as follows:

- Understand and outline current process and information flows
- Determine magnitude of change and cost of implementation associated with each proposed process change
- Determine changes in roles and information flows which will be necessary to implement new processes.
- Establish methods for sharing relevant information with everyone who needs it
- In execution, maintain constant communication across functions.

As long as the current processes and their rationale are well understood, they can be effectively reevaluated and adjusted if needed. The implementation of the changes will require careful internal examination and constant communication but has the potential to yield great savings to the grocery company.

## **Appendix A – Glossary of Terms**

Inbound: Flow of the goods from suppliers to the DCs

Outbound: Flow of the goods from DCs to the stores

Distribution Center (DC): The warehousing facility that holds products purchased from the vendors, waiting to be distributed to the stores. Every day cases of products are selected from shelves in the DC and packed onto pallets for delivery to individual stores.

Backhaul: The process of a truck returning from the original destination point to the point of origin, carrying an inbound load

Backhaul Location: Location (other than a DC/terminal) where a trailer may be dropped to be picked up a later time.

### *ABC Stores Product Groups*

Frozen: 3,125 frozen food SKUs

Dairy: 1,220 dairy product SKUs (All stores supplied by YZ DC#2)

Non-Dairy Perishable: Produce, meat, fish, floral & deli, 4,000 SKUs (All stores supplied by ABC DC#2)

Fast-moving Grocery: full-line non-perishable grocery products, approximately 5,000 of the fastest moving SKUs, example: popular name brand peanut butter

Slow-moving Grocery: full-line non-perishable grocery products with slower movement than FMG items, these represent approximately 7,100 SKUs, example: organic peanut butter

## **Appendix B – Glossary of Systems**

MAPS: This is the basic information system that stores item information.

### *Inbound operations related systems*

POM: Purchase Order Manager

LIMS: Logistics Inbound Management System

TMS: Transportation Management System

### *Outbound operations related systems*

RAIL: Rail contains delivery attributes for each item such as delivery frequency, lead time, processing time, ship-from information.

SRO & PRO: These are ordering systems located separately at each store. PRO (Perishable Re-Order) system is used for perishable items, where SRO (Supervised Order System) is used for the rest of the items.

CORE: This is the system for pooling all the orders from all of the stores. From CORE (Corporate Order Repository), the order information is distributed to ABC DCs and to YZ.

AWS: This is the warehouse management system that is established in each of ABC distribution centers and cross-dock facilities.

Manugistics: This is the routing software that plans daily routes of the trucks according to the daily order information.