



**AgEcon** SEARCH  
RESEARCH IN AGRICULTURAL & APPLIED ECONOMICS

*The World's Largest Open Access Agricultural & Applied Economics Digital Library*

**This document is discoverable and free to researchers across the globe due to the work of AgEcon Search.**

**Help ensure our sustainability.**

Give to AgEcon Search

AgEcon Search  
<http://ageconsearch.umn.edu>  
[aesearch@umn.edu](mailto:aesearch@umn.edu)

*Papers downloaded from **AgEcon Search** may be used for non-commercial purposes and personal study only. No other use, including posting to another Internet site, is permitted without permission from the copyright owner (not AgEcon Search), or as allowed under the provisions of Fair Use, U.S. Copyright Act, Title 17 U.S.C.*

# Proceedings of the Transportation Research Forum

Volume 4

1989

---



31st TRF Annual Forum  
Williamsburg, Virginia

October 11-13, 1989

19 470AA XL1  
11/94 02-013-01



**A Motor Carrier Selection Strategy For JIT Firms, by Joel D. Wisner, Graduate Student, Arizona State University, Department of Purchasing, Transportation, Operations, Tempe, Arizona.**

**Abstract**

Just-In-Time (JIT) purchasing systems result in, among other things, a reduction of raw materials inventory and an increase in incoming shipment frequency. This has placed added importance on carrier selection from the buyer perspective. Previous research has identified criteria important to the carrier selection process, however buyers are left with no objective means for measuring carrier performance within these factor areas. This article suggests a method for combining managers' subjective preferences with objective measurements when evaluating carriers for potential use. A carrier selection example is presented.

**Introduction**

The Motor Carrier Act of 1980, economic conditions at the start of the decade, and an increasing presence of overseas firms in the U.S. marketplace have caused a reevaluation of production practices, worker motivation, and management philosophies among many U.S. firms. These factors have set the stage for serious consideration of JIT practices previously thought suitable for only the Japanese working environment.

The Motor Carrier Act of 1980 eased entry regulations, making it easier for new carriers to enter the motor carrier market. Other restrictions and regulations such as one-way authority and circuitous route limitations were changed to allow greater competition between carriers. Price cutting, contract carriage, and intercorporate hauling was actively encouraged in the Act, and as a result, competition and service offerings among motor carriers have increased while rates have fallen [1].

High interest rates, economic recession, and the increasing presence of foreign-produced goods in the U.S. has forced management to consider innovative procedures to reduce inventory investment. Managers are discovering that successful implementation of JIT purchasing, manufacturing, and distribution systems can increase

customer service and product quality, while reducing costs.

Once a JIT system is in place, timing becomes crucial. The phrase, "right quantity, right place, right time" applies to every stage of the JIT process. While reducing raw materials and parts inventories is one aspect of JIT purchasing, this also increases inventory turnover and the number of incoming shipments. The timing and quality of each of these incoming shipments can mean the difference between the success and failure of JIT implementation. If a firm is operating with little or no safety stock, a late shipment can cause the entire production process to shut down until the shipment arrives. This underscores the importance of JIT firms selecting their own carriers.

These numerous, small shipments, force JIT firms to locate suppliers as close as possible to the production facility in order to minimize delivery costs and minimize the response time for delivery schedule changes. Carriers may be required to consolidate these small shipments in order to further reduce delivery costs. The flexibility, geographic coverage, and competitive cost of motor carriage causes this mode to be favored among JIT firms.

Assuming the JIT firm has made the decision to use motor carriage for transporting incoming materials, this paper discusses the carrier selection factors most often cited in the classical carrier selection problem. Areas not covered in previous research are the methods for objectively quantifying performance and reducing overlap (providing a means for delineation) in each of the criteria areas. Determining carrier performance in each of these areas can lead to a great deal of subjectivity in the carrier selection process if a framework for performance measurement is not available within each of the criteria areas. Additionally, the high level of subjectivity can lead to including some aspects of each criterion more than once. This paper suggests criteria "subfactors" that can be used to combine managers' subjective assessments (which are important in the selection process) with objective, quantifiable measurements relating to performance. Breaking down each criterion in this manner also reduces the overlap problem. An example demonstrating this performance measurement method is presented at the end of the paper.



### The JIT Philosophy and Development in the U.S.

Japanese JIT systems typically employ small, specially designed trucks to deliver suppliers' goods. The suppliers are mostly located within one day of driving time, with many locating adjacent to the buyers' production facilities. These factories are also designed for easy delivery access with delivery people commonly carrying supplies directly to the point needed in the plant.

Japanese JIT factories are typified by intense employee and supplier training, a friendly working atmosphere, a commitment to quality and getting the job done, continuous improvement, and few suppliers (Toyota has about 250 suppliers, while General Motors and Ford have thousands) [2,3].

The introduction, development, and maturation of JIT systems have been slow in the U.S. for numerous reasons. The list includes carrier regulation, the once typical adversarial relationships between management and labor unions in many industries, and the typically long distances between manufacturers and suppliers. As a result, the methods used by U.S. firms implementing JIT systems have had to adapt to these particular domestic problems.

At the present stage of development, most U.S. JIT firms (Ford, General Electric, General Motors, Westinghouse, Hewlett-Packard, Kawasaki, and Nissan to name a very few) have adopted a "quasi-JIT" system. JIT parts determination is performed using an ABC parts analysis technique and the JIT parts (Class A) are purchased and delivered daily or several times per week while the remainder are at least initially delivered in the customary manner (monthly or semi-monthly) [4].

In most instances, manufacturing firms have already established a network of suppliers and carriers when the decision to implement JIT systems is made. It then becomes necessary to evaluate current suppliers and carriage strategies to determine if the existing suppliers and carriers can adjust effectively to the JIT requirements.

### The Supplier Relationship

Firms switching to JIT operating strategies usually find they have far too many suppliers to coordinate frequent, small shipments. To have an effective JIT supply system, the firm must develop close relationships with a minimal number of suppliers to

insure proper notification of demand changes and to develop company-specific quality control methods [5]. This will help reduce downtime due to late or poor quality parts and supplies. The supplier-buyer relationship simply cannot be cultivated with the literal thousands of suppliers being used by some firms.

Suppliers are generally selected based on historical performance criteria [6,7]. Typically, JIT firms have long-standing relationships with a relatively small number of suppliers who are familiar with the firm's needs and quality requirements. JIT firms and suppliers are often found working together to solve supply item problems, production problems, and supplier-producer logistics problems. Computer linked, data interchange systems are replacing manual order and billing systems [8].

The JIT process is only as effective as its weakest link and a potential weak link in this system is the transportation link between supplier and producer.

### The Carrier Relationship

For many buyers, incoming items are purchased fob-destination, leaving the carrier choice up to the supplier. In a JIT purchasing system, this is most often not the case. Since timely delivery is such a critical issue for JIT manufacturers, the buyer must effectively monitor and control the carrier selection process.

Point-of-use receiving areas have replaced central receiving areas in most JIT applications. Carriers must be willing and their equipment must be able to accommodate this requirement [9].

Anderson and Quinn (1986) outlined four requirements for successful JIT distribution channels [10]:

1. High quality, dependable distribution process.
2. Redesign of physical distribution facilities and increasing use of drop trailers to allow delivery of parts near their point of use.
3. Modern communication and information systems that allow real-time control and monitoring of the logistics process.
4. Highly reliable transportation systems and innovative equipment.

If the firm's suppliers are currently operating in a JIT distribution channel, the incoming carrier choice may be obvious and in this case the carrier selection process will be routine. However, in most cases where a firm is changing from traditional purchasing



and production methods to JIT methods, the firm's suppliers and carriers are also operating in a traditional fashion. Historically, delivery performance has been primarily based on cost considerations. When firms implement JIT strategies, delivery performance is based on a host of considerations such as those listed above.

In a survey referred to earlier by Lieb and Miller (1988), JIT firms indicated a preference to simplify the buyer/carrier relationship. Seventy-eight percent of the firms using JIT methods were using fewer carriers, while 73% used specific contracts with their carriers. Firms stated that contracts were required to overcome carrier hesitation. Additionally, 93% of the JIT firms measured carrier performance in some way. Another notable characteristic of the buyer/carrier relationship was that 85% of the JIT firms reported an increase in shipper-carrier communication after JIT implementation. These firms also noted the major impediments to successful JIT implementation: resistance to change, cultural differences between participants, and participants being on different points of the JIT learning curve. Unwillingness or inability by one firm in the distribution channel to adopt JIT techniques can spell failure for most JIT implementations [11].

JIT firms require small and numerous (preferably daily) deliveries of JIT items. To accomplish this, carriers must be consistent, fast (efficient), and flexible. The requirement of small incoming lots forces most incoming shipments (unless the supplier is located close to the buyer) to go through an assembly and distribution or LTL consolidation process before they can be economically delivered. Traditional methods of delivery focused on fewer deliveries and TL shipments to gain economies of density.

Customized services are offered by fully integrated, or "one stop shopping" carriers and are becoming more and more commonplace as the demand for more custom services increases [12]. Unfortunately, service reliability problems increase with the use of consolidation centers where freight goes through unloading, decoupling, sorting, tagging, registration, loading, and matching processes. Shipments can become lost or damaged under these conditions [13]. This places an added burden on the carrier selection process.

Carriers have also adopted other strategies to attract JIT business such as rate discounting, guaranteed service-level

contracting, and use of on-line information systems [14].

#### **Carrier Selection Criteria**

Several articles have appeared in recent journals discussing factors considered and methods used to evaluate carriers. Among them, Bruning and Lynaugh (1984) found that most transportation managers performed subjective rather than quantitative carrier evaluations [15].

Bagchi et al. (1987) used factor analysis to reduce an extensive list of carrier selection factors into four groups: rate related factors, customer service factors, claims handling and follow-up factors, and equipment availability and service flexibility factors. Customer service factors were found to be most important to JIT firms. Additionally, all four factor groups were found to be more important to JIT firms than non-JIT firms [16].

Others studies also identify relevant performance criteria through the use of questionnaires, interviews, and other empirical methods [17,18,19,20,21,22].

In summary, firms adopting a JIT philosophy should consider all or most of the following criteria when selecting a carrier: on-time performance, commitment, equipment availability, route availability, flexibility, freight rate, preventive maintenance, shipment tracking, communication capability, service record, sales and service force level, loss and damage performance, financial stability, and reputation.

A brief description of these factors follows:

#### On Time Performance

For the JIT firm, this factor is understandably the most important. On time performance for motor carrier delivery systems can be measured as the number of on-time deliveries divided by the total number of deliveries for a given period of time. Thus, for JIT firms to be successful, the delivery service level must be close to 100%. Failure to achieve such a high level of service will result in delays on the shop floor leading to plant shut downs unless safety stock is carried.

#### Commitment

This factor is somewhat subjective and depends on past knowledge of the carrier firm's willingness to provide desired services. In this case, the term commitment is used to describe the carrier firm's willingness to develop close, long term associations with the buyer, to develop effective communication



links with the buyer, to develop methods to reduce lost or damaged shipments, to cooperate with the carrier training efforts of the buyer, to provide the assigned drivers, and to otherwise develop a team member attitude with the buyer.

#### Equipment Availability

The material handling capabilities of the carrier must be determined to see if they are compatible with buyer requirements. This may be simple to determine if the firm is selecting from carriers that have successfully delivered their shipments in the past. However, an on-site inspection of carrier equipment may be desired if the buyer is unfamiliar with the particular carrier.

Equipment availability can be measured in terms of fleet size, innovative equipment available, fleet quality (age of equipment), intermodal arrangements (if required), and assembly and distribution capability (if required).

#### Route Availability

The carrier must be able to perform pickup and delivery services at the desired buyer/supplier locations. Obviously, the more coverage a carrier can provide, the fewer the number of carriers the buyer firm must evaluate and use. Again, the idea of proper carrier selection is to use a small number of carriers so that communication and reliability are enhanced. Route availability can easily be determined through discussion with carrier representatives.

#### Flexibility

This factor refers to the carrier's ability to deviate from agreed upon delivery schedules and load sizes. Because JIT firms have minimized work in progress (WIP) and raw material inventories, a change in demand or machinery failure may temporarily change delivery requirements or load sizes. Carriers should have the ability to effectively deal with these inescapable occurrences.

As in many of the factors listed, buyers wanting to measure degree of compliance in this factor will have to rely on previous experience and/or subjective judgements based on conversations with carrier representatives and other users of carrier services.

#### Freight Rate

While not as critical to the JIT purchasing firm as service factors, the freight rate is a major determinant of total logistics cost and must be considered when evaluating carriers.

Contract rates and tariff discounts can differ substantially from one carrier to another depending on the negotiating abilities of the buyers and carriers, the existing competition on a particular route, and the financial condition (or lack of clients) of the carrier. Firms should not rely on published tariffs to determine common carrier rates due to discounts frequently offered by carriers.

#### Preventive Maintenance

An effective preventive maintenance program is required for JIT carriers to minimize equipment breakdowns. Buyers can determine the extent of preventive maintenance at various carriers by noting the number of miles or hours between basic preventive maintenance and major maintenance procedures.

#### Shipment Tracking

The ability of a carrier to quickly track shipments is important for the buyer to adequately monitor deliveries. Methods for shipment tracking range from extensive and time consuming manual paper systems to highly efficient, fast computer information systems.

#### Communication Capabilities

Communication is a vital link between buyer and carrier. Electronic Data Interchange (EDI) systems used more often for the buyer/supplier link can also be used to link buyers and carriers. These systems reduce paperwork and time required to communicate delivery schedule and load changes to carriers. The presence of these systems in both the carrier terminal and the vehicles themselves can greatly improve the JIT implementation process.

#### Service Record

Regardless of promises by carrier representatives, the service record of the carrier can give the buyer a clear idea of the quality of service provided by the carrier. Extensive conversations should take place between the buyer and other buyers familiar with the carrier if the interested firm has no direct knowledge pertaining to prior performance.

Of particular interest should be the carriers previous and current experience with JIT deliveries.

#### Sales and Service Force

The ability of the carrier to provide adequate service to the producer is determined partly by the number of service repre-



sentatives. If sales and service people are constantly unavailable, problems can turn into plant shutdowns. The buyer should determine the number of persons servicing the account for each potential carrier.

There is a particular advantage for the carrier that uses the same drivers for a JIT account. Familiarity with delivery procedures and plant unloading locations will decrease delays.

#### Loss and Damage Performance

While buyers wish to keep shipment losses and damage from occurring, the inevitable lost or damaged shipment does occur and the buyer should be aware of how these losses are handled by the carrier. Buyers should be familiar with the insurance carried by the particular motor carriers and how claims are handled.

Comparisons between carriers can be made by determining the percentage of shipments where damage or loss occurs, the average time to receive claim reimbursement, and the willingness of the carriers to pay penalties for production disruptions due to shipment loss or damages.

#### Financial Stability

The financial condition of the carrier should be of interest to the JIT purchaser. A carrier may be able to provide high levels of service at the lowest price and still be unacceptable to the buyer if the carrier's financial stability is suspect. Financial analysis of a carrier can be determined through comparison of financial statistics (current ratio, operating ratio, etc.) with industry averages.

#### Reputation

Similar to the service record factor, the carrier's reputation should be known to the buyer. This factor covers any intangible elements not covered with other factors and should be considered with caution. Good reputations can precede poor performance. Buyer firms should seek advice from other firms engaged in JIT practices as to reputation of motor carriers.

#### Carrier Selection Strategies

Once the firm has identified the important performance criteria to consider when choosing a motor carrier, a method is required whereby comparisons between carriers can be made.

After reviewing and obtaining the comparable information on the factors listed

above, the JIT firm should have considerable knowledge of the potential carriers.

The basic method of carrier selection should follow these procedures: specify carrier requirements pertaining to the performance criteria as completely as possible; identify as many criteria subfactors as possible; collect responses to each of the performance criteria and subfactors from interested carriers; closely examine the responses to determine if they meet minimum acceptable performance levels as judged by management; discard carriers that exhibit unacceptable responses; evaluate the remaining carriers based on performance between the minimum acceptable and ideal levels; choose the highest rated carrier(s) and negotiate contract terms; conduct post-selection performance audits. Because the carrier selection process is both complex and subjective, firms should attempt to eliminate as many carriers as possible before comparisons are made between carriers.

The recommended comparison technique is outlined as follows:

1. Assign weights to the criteria ranging from 1.0 (most important) to 0.0 (not important). The weights can be assigned based on evaluator or management judgement. Alternately, for the firm using the 14 criteria listed in this article, a weight of 0.1333 could be assigned to the most important criterion (14/105), 0.1238 to the next most important criterion (13/105), 0.1143 to the third highest rated criterion and so on down to the least important which receives a weight of 0.0095 or (1/105). (The reader should note that  $14+13+...+1=105$ ).

2. To minimize subjectivity, identify as many criteria sub-factors as necessary under each of the performance criteria listed in Step 1. For example, under the criteria "commitment", the subfactors "long term contract willingness", "customized training willingness", "permanent driver assignment", and "team member attitude" might be considered to determine overall firm commitment.

3. Assign factor weights to each subfactor as in Step 1.

4. Establish minimum acceptable standards of performance for each criterion or subfactor. For example, using the criterion "on time deliveries" the firm may wish to only consider carriers with an on time delivery history of 95% or more. Similarly, qualitative or quantitative standards can be established



for each of the major performance criteria and/or criteria subfactors.

5. Eliminate firms that do not meet the minimum acceptable standards. (Standards for some of the less important criteria may need to be relaxed so as not to eliminate carriers that perform extremely well in the most important areas). Again, this is a somewhat subjective decision on the part of the decision maker.

6. Assign scores from zero to 1.0 to each performance criterion or subfactor based on performance in the area in question. For example, a score of 1.0 might be given to a firm with the willingness to develop long term contracts while a score of 0 might be given to a firm that is not willing to operate under a long term contract. Performance above the ideal will be given the maximum score.

7. Multiply each subfactor score by the respective importance weight.

8. Add the weighted subfactor scores for each carrier to determine the carrier performance for each criterion.

9. Multiply each criterion score by the respective importance weight.

10. Add the weighted criterion scores to determine the carrier's overall rating.

11. Choose the highest rated carrier(s) for contract negotiation.

12. Re-calculate carrier rating score periodically.

#### Carrier Evaluation Example

Consider the three carriers, A, B, and C, exhibiting performance characteristics as displayed in Table I.

The next step in the carrier selection process is to eliminate as many of the carriers as possible by comparing their performance to the M.A.L. (minimum or maximum acceptable level). It is readily apparent that Firm C can be eliminated due to failure to meet the commitment (number of assigned drivers), equipment availability (number of assigned trucks), and communication capability (buyer-terminal-driver communication) standards. Firms A and B meet all the minimum standards, therefore the ultimate carrier choice is between carriers A and B.

The performance scores for each of the two remaining carriers appear in Table II. The performance rating of "yes" receives a score

of 1.0, while "no" receives a score of 0. Similarly, excellent=1.0, good=0.75, fair=0.50, and poor=0.25. The remaining performance levels are calculated by interpolating between the minimum or maximum acceptable levels (M.A.L.) and the ideal levels. Thus, the overall performance score becomes a percentage of the evaluator's "ideal" carrier. Based on the methods used in this example, Firm B would be preferred over Firm A. The weights and scores used in this example were chosen by the author. Other methods for determining weights and scores will vary from firm to firm.

The weighted scoring technique used here demonstrates how objective, subjective, qualitative, and quantitative measurements can be combined in the carrier decision process, reducing the high level of subjectivity and factor overlap present in many traditional weighted factor decision models.

#### Conclusions

A new era in transportation strategy in the U.S. has recently begun, with the growing trend in JIT purchasing, production, and distribution. These changes require buyers, suppliers, and carriers to establish close, long-lasting ties with one another in order to provide quality products at competitive prices to the user.

One way firms can lower total logistics cost is to select the right carriers. This selection process is even more critical for firms adopting Just-In-Time methods.

Firms should identify performance criteria and subfactors critical to the success of the supply-delivery process, either through past experience, discussions with other firms having similar operating characteristics, discussions with third party logistics representatives or transportation consultants, and discussions with the carriers themselves. These performance factors can then form the basis for carrier selection, allowing both subjective preferences and objective measurements.

While there is an ongoing attempt to identify better carrier selection heuristics resulting in optimal total logistics cost (23,24), the use of a weighted factor decision model such as presented in this paper will bring the shipper closer to the optimal carrier decision.



TABLE I

Factors	S.F. Wght	Crit Wght	M.A.L.	Ideal	Firm A	Firm B	Firm C
1. On Time Del.		.133	.95	1.00	.99	.96	.96
2. Commitment		.124					
LT Contract	.400		yes	yes	yes	yes	yes
Training	.300		yes	yes	yes	yes	yes
No. Drivers	.200		2	3	3	2	0
Team Member	.100		yes	yes	yes	yes	yes
3. Equip. Avl.		.114					
Design	.333		good	excl	good	excl	good
No. Assigned	.267		2	3	2	2	0
Avg. Age	.200		10yr	0yr	5yr	3yr	8yr
Intermodal	.133		no	yes	no	yes	no
A & D	.067		no	yes	yes	yes	yes
4. Route Avl.		.105	good	excl	good	good	good
5. Flexibility		.095					
Labor Flex.	.500		good	excl	excl	good	good
Vehicle Flex.	.333		good	excl	good	excl	good
Storage Flex.	.167		-	excl	good	excl	excl
6. Freight R.		.086	\$45PT	\$35PT	\$40PT	\$38PT	\$41PT
7. Prev. Maint.		.076					
Basic Maint.	.667		8000M	3000M	6000M	5000M	5000M
Major Maint.	.333		50000M	25000M	30000M	25000M	30000M
8. Sh. Tracking		.067	good	excl	excl	excl	excl
9. Comm. Cap.		.057					
Byr-Tmnl-Dvr.	.667		yes	yes	yes	yes	no
Buyer-Driver	.333		no	yes	no	yes	no
10. Service Rec.		.048					
Current JIT	.667		no	yes	yes	yes	no
Previous JIT	.333		no	yes	no	yes	no
11. Sales & Serv		.038	1	1	1	2	2
12. Loss & Dam.		.029					
% Losses	.500		1%	0%	.7%	.5%	1%
Reimb. Time	.333		900	300	600	300	300
Penalty Pmnt.	.167		no	yes	yes	no	no
13. Fin. Stab.		.019					
Current Rat.	.500		1.0	1.5	1.25	1.40	1.6
Oprting Rat.	.333		.95	0.9	.94	.91	.90
Erngs. Grwth.	.167		-.05	.10	-.02	.06	.12
14. Reputation		.010					
Direct Knowl.	.667		no	yes	no	yes	yes
Indirect Knl.	.333		no	yes	yes	yes	yes

Generated at University of Minnesota on 2021-10-21 16:22 GMT / https://hdl.handle.net/2027/mdp.39015031266342  
 Creative Commons Attribution-NonCommercial-NoDerivatives / http://www.hathitrust.org/access\_use#cc-by-nc-nd-4.0

TABLE II

Factors	Firm A	Firm B
1. On Time Del.	.133(0.8)= .106	.133(0.2)= .027
2. Commitment	.124X:	
LT Contract	.4(1.0)= .050	.4(1.0)= .050
Training	.3(1.0)= .037	.3(1.0)= .037
No. Drivers	.2(1.0)= .025	.2(0.0)= .000
Team Member	.1(1.0)= .012	.1(1.0)= .012
3. Equip. Avail.	.114X:	
Design	.333(0.0)= .000	.333(1.0)= .038
No. Assigned	.267(0.0)= .000	.267(0.0)= .000
Avg. Age	.2(0.5)= .011	.2(0.7)= .016
Intermodal	.133(0.0)= .000	.133(1.0)= .015
A & D	.067(1.0)= .008	.067(1.0)= .008
4. Route Avail.	.105(0.0)= .000	.105(0.0)= .000
5. Flexibility	.095X:	
Labor Flex.	.5(1.0)= .048	.5(0.0)= .000
Vehicle Flex.	.333(0.0)= .000	.333(1.0)= .032
Storage Flex.	.167(0.75)= .012	.167(1.0)= .016
6. Freight Rate	.086(0.5)= .043	.086(0.7)= .060
7. Prev. Maint.	.076X:	
Basic Maint.	.667(0.4)= .020	.667(0.6)= .030
Major Maint.	.333(0.8)= .020	.333(1.0)= .025
8. Sh. Tracking	.067(1.0)= .067	.067(1.0)= .067
9. Comm. Cap.	.057X:	
Byr-Tmnl-Dvr.	.667(1.0)= .038	.667(1.0)= .038
Buyer-Driver	.333(0.0)= .000	.333(1.0)= .019
10. Service Rec.	.048X:	
Current JIT	.667(1.0)= .032	.667(1.0)= .032
Previous JIT	.333(0.0)= .000	.333(1.0)= .016
11. Sales & Serv.	.038(1.0)= .038	.038(1.0)= .038
12. Loss & Dam.	.029X:	
% Losses	.5(0.3)= .004	.5(0.5)= .007
Reimb. Time	.333(0.5)= .005	.333(1.0)= .010
Penalty Pmnt.	.167(1.0)= .005	.167(0.0)= .000
13. Fin. Stab.	.019X:	
Current Rat.	.5(0.5)= .005	.5(0.8)= .008
Oprting Rat.	.333(0.2)= .001	.333(0.8)= .005
Erngs. Grwth.	.167(0.2)= .001	.167(0.73)= .002
14. Reputation	.010X:	
Direct Knowl.	.667(0.0)= .000	.667(1.0)= .007
Indirect Knowl.	.333(1.0)= .003	.333(1.0)= .003
Total Score	.591	.618



**Endnotes**

1. Sampson, R., M. Farris, D. Shrock, *Domestic Transportation: Practice, Theory, and Policy*, Boston, Massachusetts, Houghton Mifflin Co., Fifth Edition, 1985.
2. Blumenfeld, D., L. Burns, C. Daganzo, M. Frick, R. Hall, "Reducing Logistics Costs at General Motors," *Interfaces*, January-February, 1987, pp. 26-47.
3. Jackson, G., "Just-In-Time Production: Implications for Logistics Managers," *Journal of Business Logistics*, Vol. 4, No. 2, 1983, pp. 1-19.
4. Ansari, A. and J. Heckel, "JIT Purchasing: Impact of Freight and Inventory Costs," *Journal of Purchasing and Materials Management*, Summer, 1987, pp. 24-27.
5. Lieb, R. and R. Miller, "JIT and Corporate Transportation Requirements," *Transportation Journal*, Vol. 27, No. 3, 1988, pp. 5-10.
6. Leenders, M., H. Fearon, and W. England, *Purchasing and Materials Management*, Homewood, Illinois, Richard D. Irwin, Eighth Edition, 1985.
7. Soukup, W., "Supplier Selection Strategies," *Journal of Purchasing and Materials Management*, Summer, 1987, pp. 7-11.
8. Anderson, D. and R. Quinn, "The Role of Transportation in Long Supply Line Just-In-Time Logistics Channels," *Journal of Business Logistics*, Vol. 7, No. 1, 1986, pp. 68-87.
9. Perry, J., "Firm Behavior and Operating Performance in Just-In-Time Logistics Channels," *Journal of Business Logistics*, Vol. 9, No. 1, 1988, pp. 19-33.
10. Same reference as Endnote 8.
11. Same reference as Endnote 5.
12. Morash, E., "Customer Service, Channel Separation, and Transportation Intermediaries," *Journal of Business Logistics*, Vol. 7, No. 1, 1986, pp. 89-107.
13. Sheffi, Y., "Carrier/Shipper Interactions in the Transportation Market: An Analytical Framework," *Journal of Business Logistics*, Vol. 7, No. 1, 1986, pp. 1-27.
14. Bagchi, P., T. Raghunathan, and E. Bardi, "The Implications of Just-In-Time Inventory Policies on Carrier Selection," *Logistics and Transportation Review*, Vol. 23, No. 4, 1987, pp. 373-383.
15. Bruning, E. and P. Lynagh, "Carrier Evaluation in Physical Distribution Management," *Journal of Business Logistics*, Vol. 5, No. 2, 1984, pp. 30-47.
16. Same reference as Endnote 14.
17. Baker, G., "The Carrier Elimination Decision: Implications for Motor Carrier Marketing," *Transportation Journal*, Vol. 24, No. 1, 1984, pp. 20-29.
18. Bardi, E., "Carrier Selection from One Mode," *Transportation Journal*, Fall, 1973, pp. 23-29.
19. Crainic, T., "Operations Research Models of Intercity Freight Transportation: The Current State and Future Research Issues," *Logistics and Transportation Review*, Vol. 23, No. 2, 1987, pp. 189-206.
20. Same reference as Endnote 3.
21. Same reference as Endnote 5.
22. Same reference as Endnote 13.
23. Same reference as Endnote 13.
24. Same reference as Endnote 7.